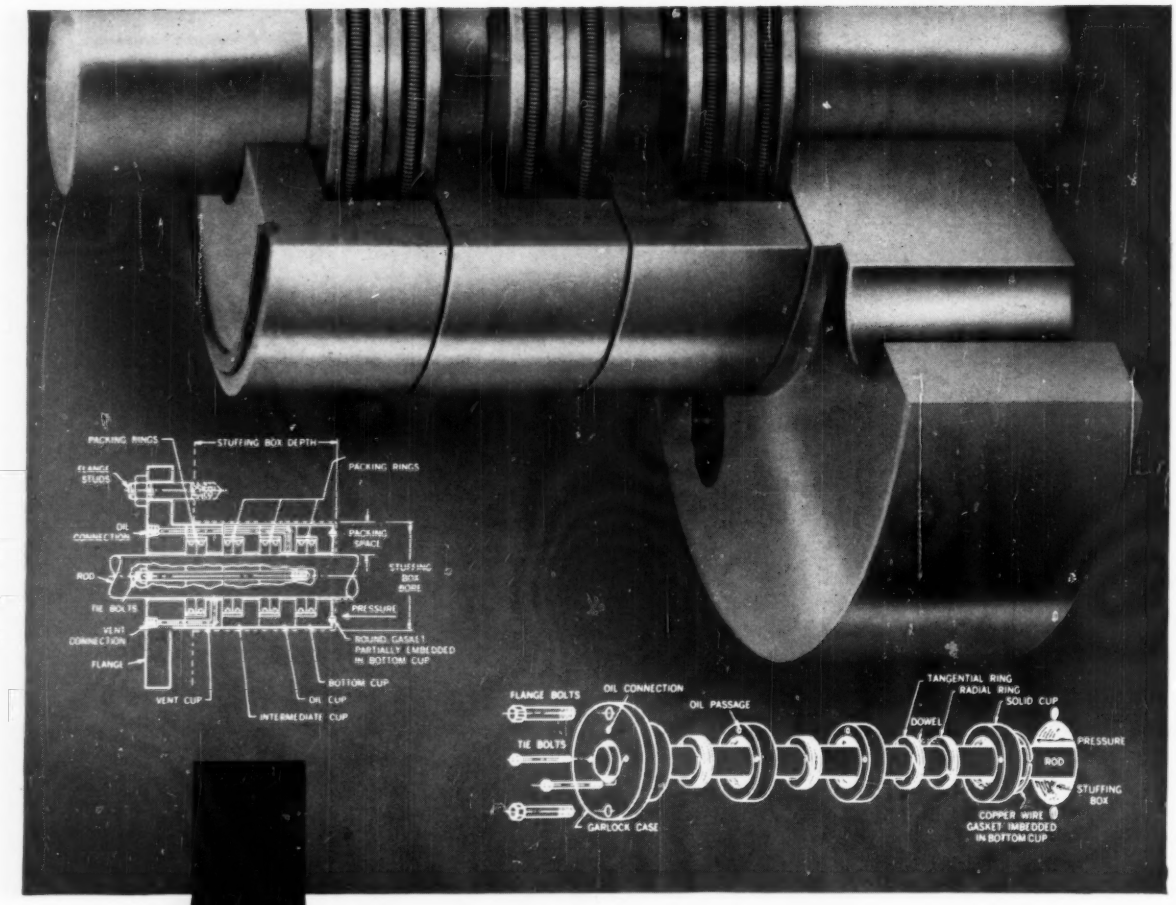
Compressed Air Magazine

DECEMBER 1961

IN THIS ISSUE:
CONQUERING ROCK AND SWAMP
DECONTAMINATING WATER
GENERATING CARBON DIOXIDE
MAKING AIR FOR RAILROADS
PINNING TUBES TO ROCKS



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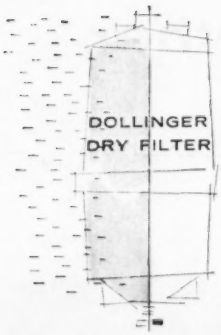

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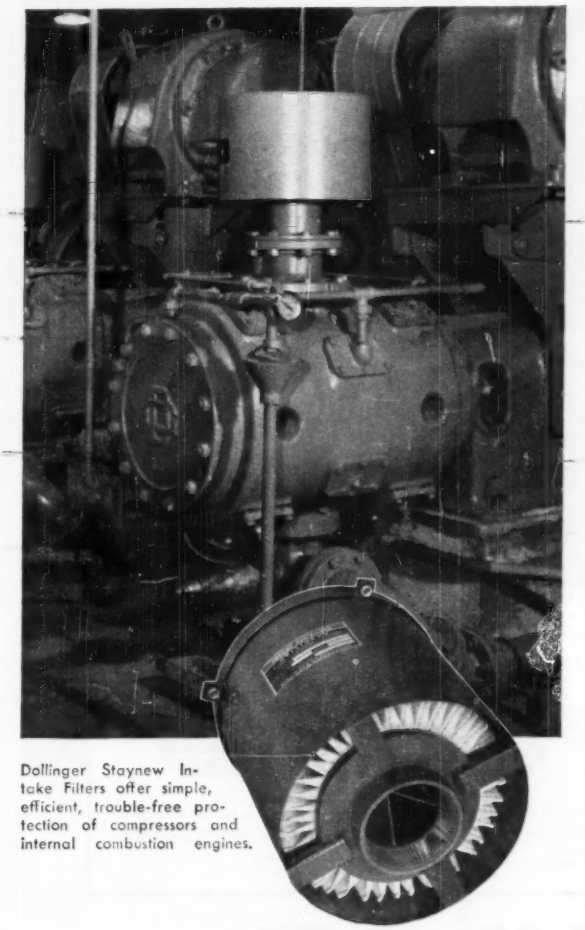

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on the cover

Photographer E. C. Jaeger calls this picture "Blizzard." It seems to recall snowy holidays and, perhaps, the lane to grandmother's home. With it, and with whatever good memories it may evoke, we convey to our readers best wishes of the Season and for the coming New Year.

6 **New Road to Manhattan**—R. J. Nemmers
I. Lower Deck for George Washington Bridge
II. Rock and Swampland Yield to Air Power

The first part of this article describes general features of the current work in progress on both sides of the Hudson River. Part II describes a central stationary air plant for rock drilling and the use of portable compressors for driving sand piling.

12 **Fresh Water Where You Want It**—S. M. Parkhill

Badger vapor compression stills can turn contaminated or salt water into potable fresh water at reasonable cost. The units are portable and make use of aluminum and new design fundamentals to achieve light weight.

15 **Jumbos for a Mammoth Tunnel**—Robert J. Brown, Jr.

Yellowtail Dam will back up the Big Horn River to provide water for irrigation, power generation and to control floods. This page tells about the rock drill equipment for the 2000-foot-long tunnel that is a part of the project.

16 **Do-It-Yourself Carbon Dioxide Plants**—A. L. Trumpler

Carbon dioxide uses have grown tremendously in recent years. This equipment provides on-site generation of CO_2 in large quantities.

22 **Self-Propelled Compressors for Maintenance-of-Way**—C. H. Vivian

Something has been added to conventional portable compressors to increase their usefulness to railroads.

25 **Terzaghi and Ferris Voted Moles Awards**

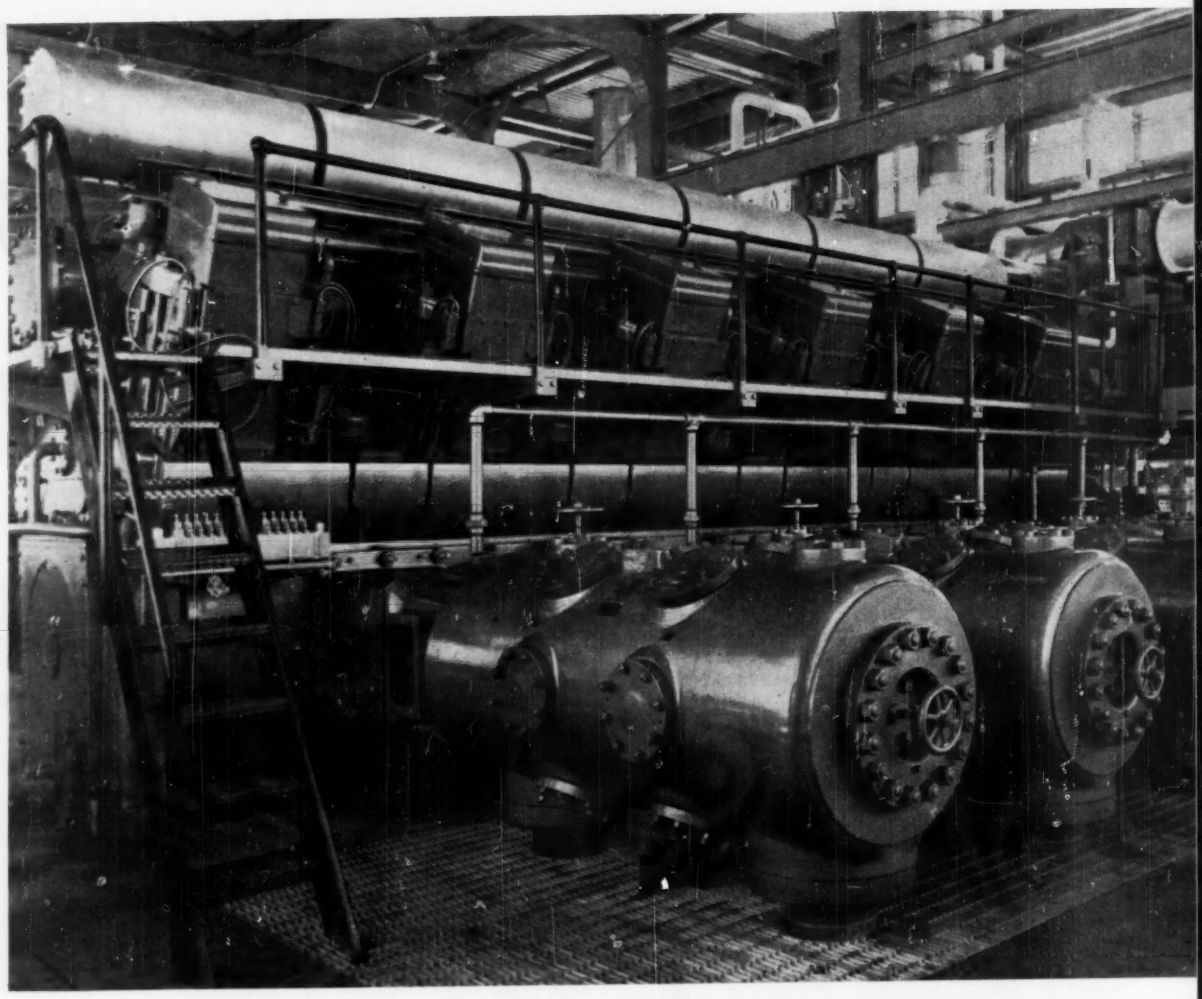
The 1962 recipients of the Moles Awards are announced.

26 **Pinning Problem Solved**

Compressed air powered drills cut coolant tubing installation costs at Glen Canyon Dam.

DEPARTMENTS

19 **Preventive Maintenance for Rock Drills, III**
24 **This and That**
27 **Editorial**—Winter
28 **Industrial Notes**
40 **Index to Advertisers**



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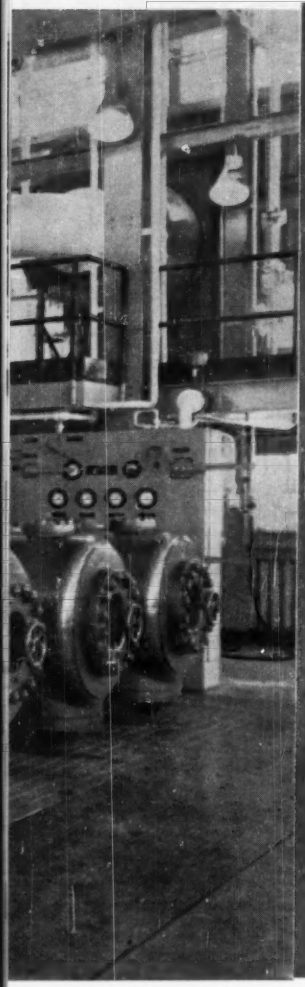

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The World's Most Comprehensive Compressor Experience

New Road to Manhattan

R. J. Nemmers

I. Lower Deck for George Washington Bridge

PARAPHRASING a couple of old cliches, one tourist remarked that "New York is a wonderful place to visit, if you can get there." He was only echoing the plaint of thousands of commuters who daily tangle with the phenomenal flows of people and products to and from the City of New York.

That the situation is no worse than it is, and that it is, indeed, getting better in some respects, is due to the mammoth works of the Port of New York Authority. The public corporation, an agency of the states of New Jersey and New York, has more than $920 million invested in six bridges and tunnels, five airports including a heliport, and ten truck, railway and ship terminals and piers. One of its most recent major undertakings will add an additional $183 million to this investment in the future of the Port area. Its focal point is the completion of the George Washington Bridge, originally opened to traffic in 1931.

The word *completion* is chosen advisedly because the bridge was originally designed by Othmar H. Ammann to have both an upper and lower deck. Until now, it has been able to handle all traffic without the lower deck, but the last few years the load has been very close to capacity. In 1955 part of a traffic report prepared for the Authority indicated the need for a major northern route into and bypassing the Borough of Manhattan. The report evolved into the current work including the addition of the long-planned, lower, 6-lane level of the bridge itself. The project is expected to be completed and in full operation by late 1962.

The lower deck cost only $25,000,000, a relatively inexpensive sum when it is considered it will boost present capacity of the 8-lane upper deck by 75 percent. The work was contracted to Bethlehem Steel Company and is nearing completion. Such arteries as this are of no avail, however, unless approaches at either end of the crossing are equipped to handle the millions of vehicles. Thus it is that an additional $158 million is required to bring the approaches up to date to handle the increased flows.

The George Washington Bridge is an important link in the National System of Interstate Highways. As such, its connecting routes are eligible for funds under the Federal Aid to Highways plan, although the bridge itself is not. Working with the New York State Department of Public Works and the New Jersey State Highway Department (and through these agencies, with the Federal Bureau of Roads) the following criteria for oper-

ation of the bridge were established that have governed the design and routing of approaches.

(1) That the two middle lanes of the upper level would continue to be reversible as they now are. Thus eight of the total fourteen lanes will be available for traffic using the bridge in the direction of heavier flow.

(2) That motorists can use either the upper or lower level to reach any connecting highway.

(3) That the lower level can be closed during periods of light traffic without inconvenience to users.

In The City

A multifaceted program is underway to improve the handling of present traffic flowing to and from the bridge as well as to take care of the new loads resulting from completion of the lower deck next year. Connections between the upper level and Henry Hudson Parkway and Riverside Drive are being modified to eliminate sharp curves. New ramps to the lower level are being built.

Just beyond these main connecting routes, a spacious bus station and bus parking annex is under construction to enable interstate buses to enter and leave the city without using congested city streets. Direct ramps will lead to and from the bridge. Nearly 2000 buses will handle some 50,000 passengers daily—well over 200 buses and 10,000 people in a peak hour. The bus terminal is part of the Authority program.

Under the new terminal, the main bridge ramps blend smoothly into a 12-lane depressed roadway running crosstown parallel to and between 178th and 179th streets. This George Washington Bridge Expressway will connect both levels of the bridge with Amsterdam Avenue, Harlem River Drive and the new Alexander Hamilton Bridge spanning the Harlem River to the Bronx. Connections will also be provided to the existing 181st Street Bridge over the Harlem River. The Alexander Hamilton Bridge is being built by the New York State Department of Public Works and will provide a necessary link in the northern bypass route around congested Manhattan. The network of highways made more accessible by current work, then, extends to Long Island, north to the New York Thruway, to New England turnpikes and interstate roads, or south to the Triborough Bridge.

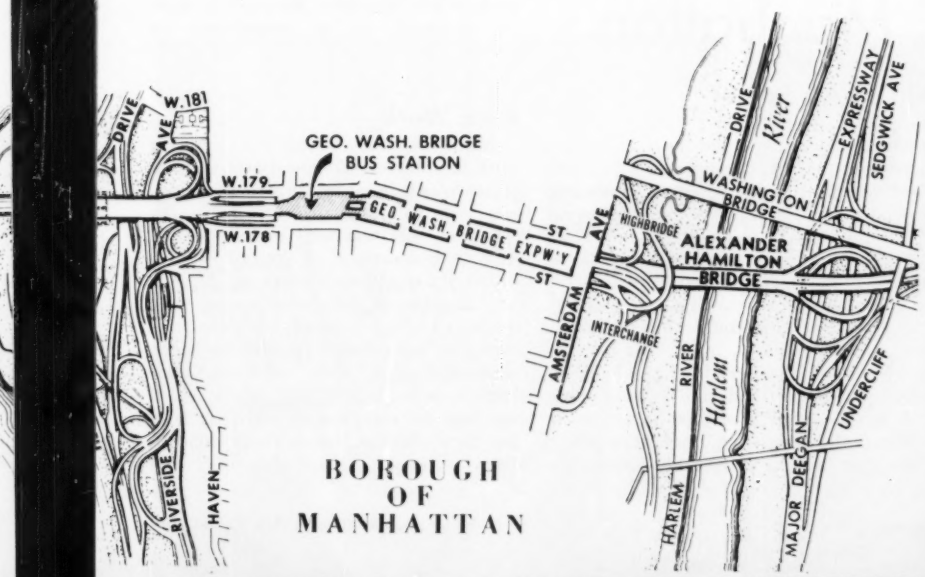
In New Jersey

To serve the new lower level of the George Washington Bridge on the New Jersey side, new ramps and approaches granting access in either direction are underway. These take the form of a pair of cut-and-cover tunnels through the Palisades. The westbound one will be 630 feet long; the eastbound, 550 feet. Both parallel the existing plaza but are on opposite sides. Each connects new lower level toll gates with depressed roadways running under Hudson Terrace, a major local artery in the Borough of Fort Lee. Two bridges to carry Hudson Terrace traffic over the new access lanes are included in the basic project. To fit in the lower lanes, the old Port Authority administration building had to be razed and a new one built to the south of the plaza between Lemoine and Center avenues. The building houses police and emergency personnel required for bridge operations.

The main New Jersey plaza serving the upper level of the bridge will remain practically as it is with only modifications as indicated by experience with traffic. Beyond it, however, new or improved connections will be built between the approaches and US 1, 9-W and 46 and NJ 4 as well as the Palisades Interstate Parkway, local streets and the Bergen-Passaic Expressway.

The latter artery is being built by the New Jersey Department of Highways as part of the Interstate net and will be Routes 95 and 80 combined for a short distance, and then Route 80. The road springs from the complex of approach roads to the bridge near Fletcher Avenue in Fort Lee, a little more than 0.5 mile from the bridge. It heads generally west to Ridgewood Park where Route 95 separates and runs down to an interchange with the New Jersey Turnpike and thence on to Trenton and south. The Expressway, as Route 80, continues generally west to a major intersection with NJ 17 near Lodi, angles north of Passaic and Clifton to an interchange with the Garden State Parkway, and runs on to Paterson and west to Pennsylvania at Delaware Water Gap.

Thus the new route will enable traffic to be carried quickly away from the city to the industrial and residential complex of northern Jersey, or to strike south to Trenton, Camden and Philadelphia. The portion to be known as the Bergen-Passaic Expressway will cost an estimated $65,000,000.



VIEW WEST **Looking west high over Manhattan. The Authority Bus Terminal is in foreground; George Washington Bridge and approaches are at top.**

VIEW EAST Looking east over Fort Lee. The new approach complex is in the foreground; the Bridge and Manhattan are just visible at the top.

New Road to Manhattan

II. Rock and Swampland Yield to Air Power

WEST, from the George Washington Bridge, the incoming and outgoing roads look much like spaghetti as they twist and wind and pass over and under each other. It is in this maze of highways that part of the current work is progressing on Interstate 80 & 95—the Bergen-Passaic Expressway. Just squeezing it in is a problem—to do it without complete disruption of traffic using the bridge is even more difficult.

Before the current program, NJ 4 was a 4-lane highway, undivided, with both east- and westbound traffic following the same line to and from the bridge. Getting the Expressway into the area called for separating the westbound portion of NJ 4 from the eastbound lanes and carrying it over the new road. In keeping with the bridge operating policy, all roads are to be accessible from either upper or lower decks, and this calls for numerous ramps and crossovers.

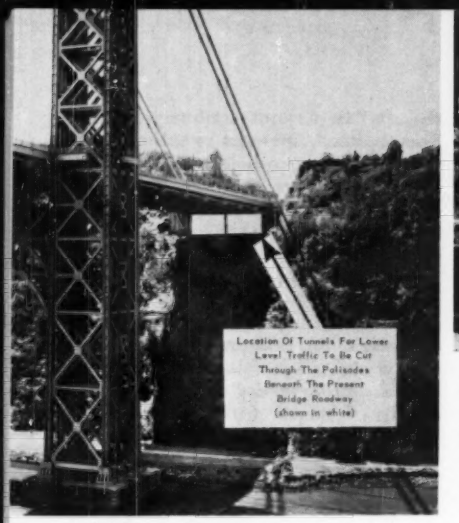
Just past Fletcher Avenue where the new Interstate road comes in, a ramp to westbound NJ 4 vaults the new road. Then, less than 0.5 mile farther along, the east lanes pass over the Expressway again, rejoining the westbound ones and heading generally north before curving west a few miles above the new route. The Expressway itself is 33 feet below the grade of NJ 4 at the intersection, having dipped gradually (about 4 percent) from the bridge plaza. Carving out the route for the new road is a considerable rock job. On the east side of the NJ 4 overpass, the shoulder of one hill must be removed for the Expressway cut. Another portion, farther up the slope, must be flattened to carry part of the NJ 4 westbound ramp. There is roughly a half million yards of rock to be taken from this area.

To the west of the overpass a high rock hill blocks the path of the Expressway through to the Jersey Meadows, a virtual wasteland of swamp and water through which the new Interstate route must pass. Carving a cut through this hill will call for the removal of about 2,000,000 yards of material, three quarters of it a hard diabase basalt. The rock is tough drilling, but fractures well—it is, in fact, an excellent traprock and is slated for another role in the over-all scheme of the highway.

As is customary, many of these more or less well defined sections of the program are broken into separate contracts, however, most contracts in this general area have been let to Geo. M. Brewster & Son, Inc., along with several others calling for soil stabilization and subbase preparation of the Meadows swamplands farther west. In all, Brewster has gathered some $40 million worth of work either under the Port Authority—for example, the construction of the cut-and-cover tunnel approaches to the bridge proper—or under the New Jersey Department of Highways. Both in the rock cuts and in the steps being taken to stabilize the Meadows, Brewster is making extensive use of compressed air power.

Rock Work

When Brewster's men first went to work on the rock sections, portable compressors, as is usual on construction projects, went in along with rock drills. By the time work was well under way, almost 30 compressors of 600- to 900-cfm capacity were in use powering about a like number of crawler-mounted rock drills as well as a variety of pneumatic tools. In the cramped quarters in which work had to be done to avoid interference with traffic, the problems of spotting the compressors and maintaining them became increasingly difficult. Brewster engineers felt that a central



COMPRESSED AIR During beginning stages Brewster moved in portables such as the battery of three 600- and one 900-cfm Gryo-Flo compressors shown above. The portables served well jobs such as the one pictured at left. In the crowded work to follow, however, Brewster engineers needed a stationary plant, as described in text. The other pictures on this page show the installation of skid-mounted XLE's, a connected unit in operation and the exterior of the building that houses the 4-machine, 8000-cfm plant.

compressor plant might solve many of their problems with better control of costs.

They also wanted a plant that could be transferred to future Brewster jobs either intact, or split for use in two or more locations. The current project, they figured, would make most economical use of a central plant delivering about 8000 cfm of air. The one installed consists of four packaged skid-mounted stationary compressors each delivering approximately 2000 cfm. The packages are 16 feet long, 10 feet wide and but 11 feet in height, making it possible for Brewster to move them along any major highway without running afoul of width, length or weight limitations. The packages have all-electric drivers and are complete in themselves when connected to air outlet and power lines. They are cooled by a closed circuit system incorporating fan-cooled radiators. Each package consists of:

Compressor—an Ingersoll-Rand 24¼ & 14½ x 10-inch XLE-2 with 5-step clearance control of capacity and full-automatic starting unloading. The standard machine has a nominal rating of 2006 cfm at 100 psig; for Brewster, pressure is boosted to 125 psig with actual delivery of 1880 cfm.

Motor—a Westinghouse 350-hp synchronous driver arranged for flange mounting directly on the compressor frame to save space.

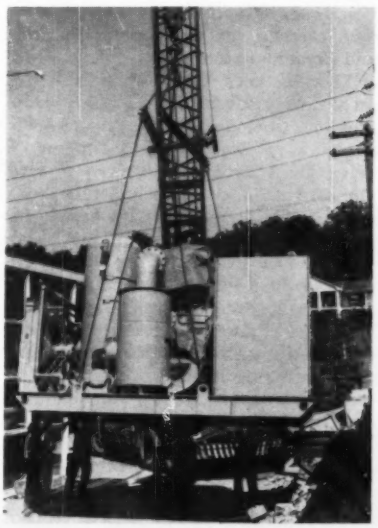
Starting equipment—a 4.5-kw motor-generator set and a fully automatic reduced voltage starter, both of Westinghouse make.

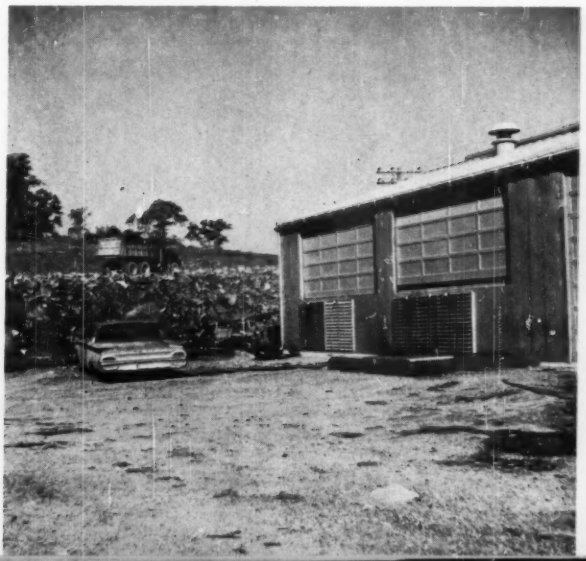
Air apparatus—an American 36 WO3 inlet filter, an Ingersoll-Rand 98 PL12 aftercooler and a 42-inch x 10-foot receiver.

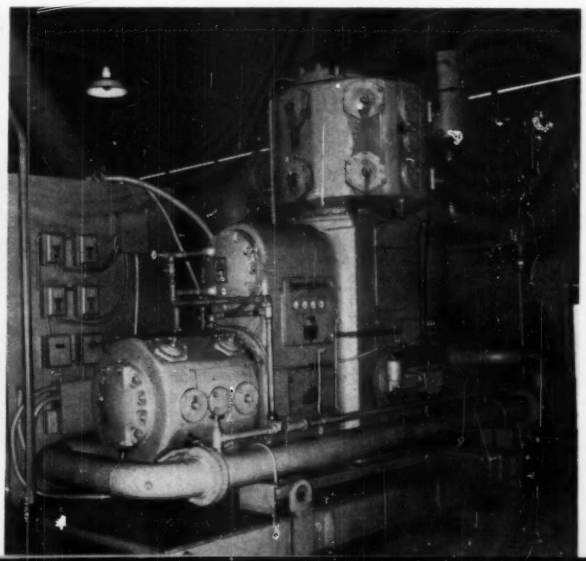
Coolant system—two Perfex DDV radiators and an I-R 1½ RVN-3 circulating water Motorpump.

Compressor protection equipment—a high-air-temperature shutdown switch, a low-water-pressure shutdown switch and a cylinder lubricant low-pressure shutdown switch. Each is wired to a panelboard indicating lamp to show the source of a failure if the machines are stopped.

To put one of the units on line, the operator needs to push only one button. Sequential controls then take over to start the motor-generator set, the radia-







tor fans and the circulating pumps. Then, after a time delay, the main motor circuits are energized. The compressor is automatically unloaded at start-up, and after reaching speed is switched to automatic clearance control regulation of output.

The four packages are housed in a fabricated steel building, 40 x 60 feet in size, erected just west of NJ 4 near the Expressway underpass. The building and compressors rest on a simple reinforced concrete slab—all the foundation needed for the smooth-running machines. The L-design compressor has an aluminum low-pressure piston, and a steel high-pressure one to equalize forces. Eight-inch headers lead from the station both ways along the new right-of-way, carrying air to supply rock drills and pneumatic tools.

The big rock cut through the hill on the west side of NJ 4 was begun on the western slope to make the problem of muck disposal easier. The cut is being sliced through with seven crawler-mounted 4½-inch drills. Although at the time material was gathered for this article, blasting techniques were still in the experimental phase, patterns of 10 x 12 feet were being used successfully, even with the limit of 30 pounds of powder per delay imposed because of near-by buildings and houses. As work moves up the slope, every effort will be made to take the full depth of the cut (90 feet at the crest of the hill) in a single lift. In this deepest section 4¾-inch machines may be brought in not only to provide extra power to reach the greater depths more economically, but to increase hole size over the present 2½ to 2¾ inches. Line-holing of the slopes is required because of the tight quarters and steep banks.

Muck is loaded by 5-yard shovels into Euclid rear dumps and hauled to a 54-inch gyrating crusher located just off the right of way at the start of the big cut. The rock is reduced to minus 8 inches in size and discharged to the first flight of a 10,900-foot-long belt conveyor system that carries it out into the Meadows where it will be used as fill and overburden in part of the Brewster contract in the swampy ground. This first conveyor section is 50 feet in length and has a 60-inch-wide belt. It feeds the 563-foot-long second section of 42-inch width. The remaining eight flights in the system are of varying lengths, but also 42 inches wide. The last flight discharges to a pair of truck bins from which the rock is dispensed to trucks as required for fill. The belts travel at a speed of 610 feet per minute with troughing idlers on 4-foot centers, return idlers on 12-foot centers. The system was manufactured by Barber-Greene Company, primarily of standard components.

The conveyor follows the road right of way past a section where Poirier & McLane forces are putting up concrete trestles to carry the road over city streets.

Stabilizing Swampland

In the Jersey Meadows, the Brewster contract calls for the placement of 56,500 sand drains to stabilize a section of the Expressway that measures just under 1¼ miles. Some of the drains go as deep as 135 feet, almost 4,000,000 linear feet being required for the job. An additional sand drain job farther west along the route is also being handled by Brewster, as well as stabilization and filling of a large area required for an interchange.

Essentially the operating principle of sand drains is one of providing some place for water to go, and then putting sufficient weight on the permeated ground in the form of overburden to squeeze out excess water. In this case a 4-foot layer of overburden is being placed first to give heavy pile-driving equipment a stable platform from which to work.

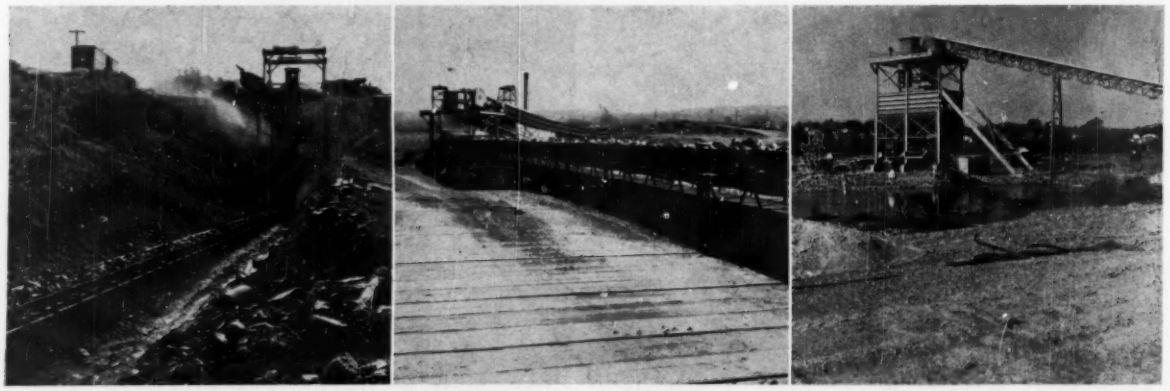
Sand is being used for the overburden and to obtain the necessary large quantities, an elaborate handling system was set up. In a joint venture with the Erie Railroad, Brewster established two rail sidings, one to hold a maximum of 90 cars in storage, the other to handle and dump as many as 60 cars without supplemental switching. Cars are dumped by an Eastern Constructors car roll-over into a sump.

The material is obtained from a quarry at Wanaque, N. J., and carried over mainline Erie tracks to the job-site sidings. Five trains of 40 cars each run a shuttle service to maintain the supply of sand. (Additional sand is barged from Long Island sources to Bogota, N. J., and hauled by truck directly to work sites.)

In the sump the sand is slurried with water brought in through a channel cut to Overpeck Creek a short distance away. The slurry is then picked up by a dredge pump and pushed through 16-inch steel pipe to the fill area 4500 feet away. The primary pump is a 10,000-gpm unit and has a 270-foot head capacity. It is driven by a 1650-hp diesel. About halfway to the discharge, a booster pump of like capacity helps push the slurry along. At the dredge pipe outlet, Cat D-8 'dozers push the sand away to form part of the overburden blanket, or push it into piles for later distribution by scrapers and loaders.

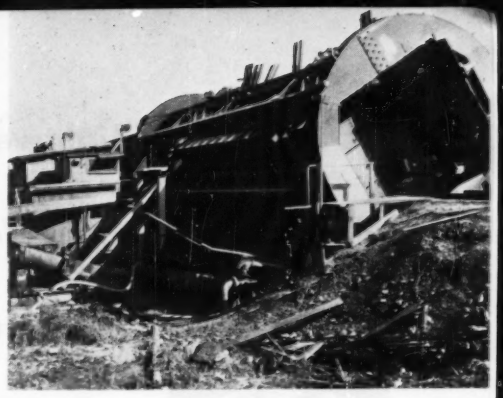
As the sand blanket is leveled, Brewster's heavy pile-driving equipment moves in to sink the sand drains. This is done by driving special steel tubes, 20 inches in diameter and ½-inch wall thickness to a depth determined by penetration rate. When penetration slows to specifications, a hopper attached to the leads and filled with sand during the driving operation is hoisted and dumped into a receiving hopper attached to the casing just below the driving block. The sand flows into the casing through a tight-sealing check valve. Then air at 100-psig pressure is introduced into the casing to hold the sand in place as the casing is slowly withdrawn.

Muck from open cuts becomes fill after crushing (left), traversing 10,900-foot-long conveyor, and dumping to Meadows hoppers (right).

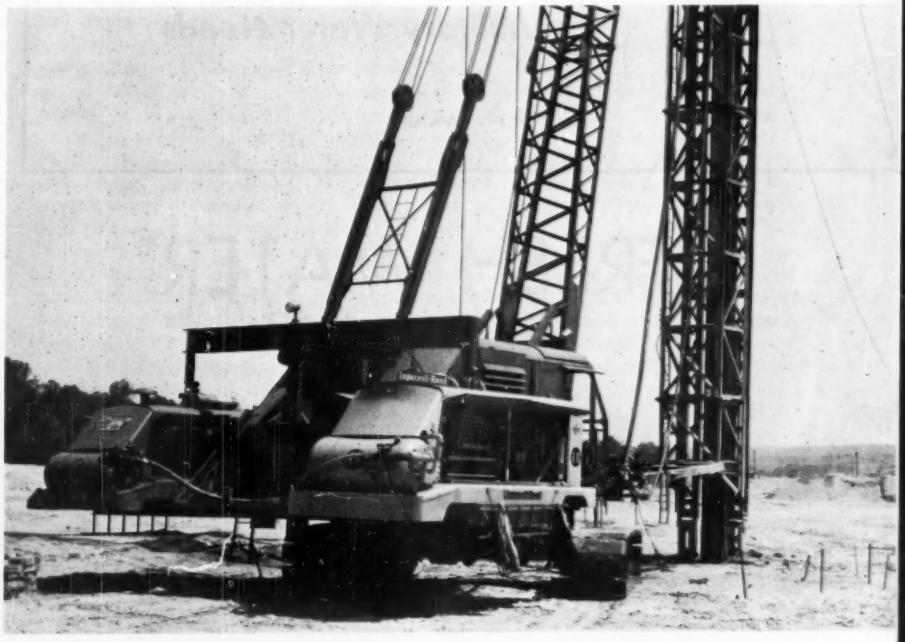


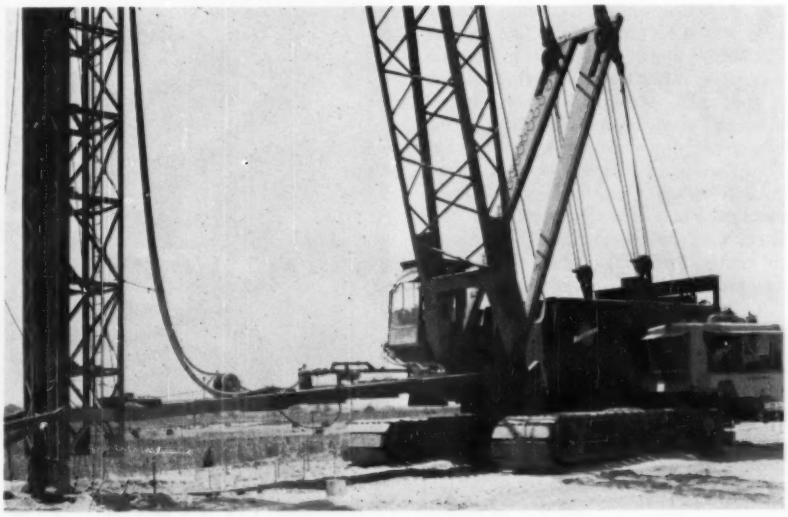
Drains are being placed on two grid patterns—one of 8 x 7 feet and the other, 7 x 6 feet. The closer spacing is in the middle of the right of way; the wider, near the edges where loads are less. Prior to placing the drains, as noted previously, an approximately 4-foot-thick layer of sand overburden was spread. After drains are in place, an additional 3 feet of sand is put on and leveled to attain the necessary weight. Settlement gauges and piezometers are then installed so that engineers can check settlement and compaction or drainage of the underlying strata. Later additional overburden will be added in the form of crushed rock from the big cut near the bridge. This will provide a suitable subbase for the actual construction of the road surface.

To handle the driving chores, Brewster has six Manitowoc 3900 cranes and one 4000 and one 4500. All are equipped with Brewster-built driving leads and Vulcan pile hammers. The 3900's have 80-C hammers and handle average depth drains; the two bigger cranes have 140-C hammers and take care of the deepest work. Each of the smaller cranes has two portable compressors to supply the hammers with air—one 600 cfm and one 900 cfm machine being slung from the rear of the crane cab in place of a portion of the counterweighting. On the 4000 and 4500 cranes, the bigger 140-C hammers call for more air—a pair of 900-cfm machines are used on each of these cranes. All of the portable compressors are Ingersoll-Rand Gyro-Flo's.

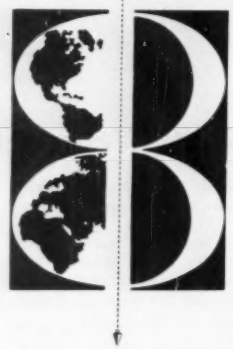


CAR DUMP Sand brought over Erie tracks is dumped to a sump in this car roll-over device. Thence it is dredge pumped to the Meadows fill area. First layer of sand provides stable ground for pile drivers; second layer, after drains are driven, adds to weight for ground water displacement.





SAND DRAINS Piling mandrels are driven to depths determined by penetration rate, sand filled, pressurized with compressed air and pulled out, leaving a sand column in place. Six rigs are equipped with Vulcan 80-C hammers and one 600- and one 900-cfm Gyro-Flo portable compressors (less running gear). Two other rigs have Vulcan 140-C hammers, and require two 900-cfm Gyro-Flo's. The 80-C hammers use air at 125-psig pressure; the 140-C's require not only more air, but air at 135-psig pressure. Compressors deliver full rated output. The picture above shows the traveling hopper which loads the mandrel. The rig at left has hopper in charging position, the one at right has hopper lowered for filling by front-end loader. Picture at top right shows 1500-cfm rig; at lower right, 1800-cfm unit. Latter picture also shows Ingersoll-Rand air-powered utility hoist used to adjust feet under hammer leads.



Lightweight And Portable, The Badger Vapor Compression Still Is A Practical Solution To Civil Defense And Military Water Needs

S. M. Parkhill

FRESH WATER*

CONTAMINANTS besides salts exist to make water worthless. Consider foulness caused during floods and hurricanes, or radioactive pollution from nuclear attack. In such cases it is necessary to have a portable still available, for land-based installations, by most odds, would not be near enough to a disaster area to be effective.

On September 15, UPI reported Texas supermarkets selling fresh water for $2.50 a gallon in the hurricane Carla disaster area. An isolated case, but one with a potential of being multiplied many times. On September 19, Director of the Office of Saline Water MacGowan requested $200,000 from the Senate Committee on Appropriations to begin work on the development of mobile and portable units.

Badger Manufacturing Company, Cambridge, Mass., has been working on the problem for years and has now developed a lightweight military field-type vapor compression distiller that boasts, among other features, excellent portability. This makes it ideal not only for

Photo, Bureau of Reclamation

*Where You Want it

military use, but for civil defense and industrial needs as well—in fact, wherever on-the-spot, high-purity water is required.

One major advantage is the fact that the still can be stored in a bomb shelter to keep it from becoming radioactive during an attack. Afterward, it can be taken out to produce pure water from contaminated feed. During the Bikini atomic bomb tests, it was proved that distillation units, even though radioactive themselves, can produce potable water. The difficulty is getting personnel close enough to put a still into operation. Badger's latest model can start functioning without being radioactive, having been safely stored, and will probably see all of a disaster period through before it becomes too "hot" to handle.

Another civil defense premium of the new still is that its present design calls for a gasoline engine. The availability of electricity after a severe storm is far more questionable than the supply of gasoline.

Development

The Cambridge firm has been active in design, engineering and construction of water evaporators since the outbreak of World War II, during which time it manufactured thousands of small units for use by the armed forces on remote islands of the Pacific and aboard certain naval craft. The present still is in this tradition; more specifically it is the fourth of a series of prototypes. It is rated at 125 gallons per hour (gph), weighs only 2800 pounds (6000 pounds with trailer mounting), and yet compares in capacity to 8300-pound cupronickel stills commonly used for industrial water purification. The unit was designed and constructed for the U. S. Army Research & Development Laboratories, Corps of Engineers, under an R & D contract with the USA Sanitary Sciences Branch.

An advantage of low power consumption-to-distillate ratio is due partly to fundamental design improvements and partly to aluminum used in the construction of many components. Aluminum provides better heat transfer than cupronickel. It was not until relatively recently, however, that a means was found by which the metal could withstand the rigors imposed on it by saline water conversion.

Under a program to find suitable materials for stills other than the long-used nickel and copper alloys, aluminum was tried. The incompatability of copper and aluminum is well documented. If all traces of copper are removed from those parts that come in contact with the brine feed, aluminum stands up quite well. Copper pitting is eliminated, and electrolytic corrosion is minimized. As aluminum construction proved feasible, work was stepped up at Badger to find a suitable design of a distillation plant using this metal. Efforts were directed by John J. Campobasso and Andrew C. Peters of its Process & Product Engineering Department.

Basis for the still is the Kleinschmidt process. At the outbreak of the Second World War, Robert V. Kleinschmidt and Allen Latham, Jr., of Arthur D. Little, Inc., were working on vapor compression evaporators to achieve higher fuel economies. Although Dr. Kleinschmidt was called to active naval duty, work continued under the direction of Dr. Latham. Eventually the process was developed. Very simply stated, here is how it works.

Salt water intake passes through a triple-passage, liquid-to-liquid heat exchanger and its temperature is raised. From the heat exchanger, the feed goes into the tube section of an evaporator-condenser and boils at about atmospheric pressure. The vapor given off is sucked out of the evaporator and compressed.

Compression superheats the steam a few degrees and at the same time raises its pressure a few pounds. The compressed steam is returned to the steam chest portion of the evaporator where it condenses at a temperature somewhat higher than the boiling point of the brine. Thus heat given up by the steam stimulates continued boiling in the evaporation compartment. No useful work is done; the state of the water is simply changed.

Hot condensate is pumped from the evaporator-condenser through the heat exchanger where sensible heat raises the temperature of the salt water feed. Concentrated brine is also drawn off and flows through the heat exchanger, giving up its sensible heat too. Fuel economy depends on the compression of vapor leaving the evaporation compartment so that it can be used in the steam chest, or shell (that area surrounding the tubes in the evaporator), in place of formerly applied process steam.

Process

Badger eventually purchased all Kleinschmidt patent rights and since the war has continued developing and refining the efficiency of the process. In detail, this is how it is applied to the aluminum, 125-gph Badger distilling unit.

The system consists of the standard four interconnected parts: heat exchanger, evaporator-condenser, vapor compressor, and gasoline engine power unit. Feed water at 63° F* is drawn through a basket strainer and pumped at 4 gpm (at 50-psig total dynamic head) into a 3-stream aluminum-plate American Heat Reclaiming Corporation heat exchanger (Type 23-L). Plate type rather than either a multi-pass shell-and-tube or a triple-concentric-tube exchanger of the first Kleinschmidt stills, was used because it better serves the thermodynamic requirements. Flow velocity is high; pressure drop, low. Liquid-to-liquid heat exchangers recover sensible heat of both the distilled water and dense hot brine discharged from the evaporator. Thus, through compression and efficient heat exchange, results are virtually equivalent to those that might be realized when using twelve to fifteen stages in a multiple-effect steam-fired evaporator.

Feed then passes through the engine water cooler and continues to a vent condenser where noncondensibles from the evaporator are removed from the system. From the vent condenser, feed water (by now within 10 degrees of boiling) goes to the evaporator where it boils at atmospheric pressure.

The evaporator is a vertical-tube, thermal-circulation Badger Model 16780-2, constructed entirely of aluminum. It is 28 inches in diameter, nearly 5 feet high, and contains 280 square feet of heating surface. There are 604 tubes, each $^{3}/_{4}$ inch in diameter, in which the salt water boils. This is the most efficient size for heat transfer. Smaller tubes might be better on this score, but scaling would then become a major problem. Each tube is about 30 inches long, the over-all height of the plant and trailer being limited by military specification.

Vapor compression is handled by an Ingersoll-Rand Size 562 x 9 Axi-compressor with aluminum suction and discharge end housings, aluminum drive and gear end covers; and Ni-P.esist main and gate rotor shafts, labyrinth seal bushings and bearing spacers. It is rated at 540-cfm capacity at 1800 rpm. Suction pressure is 0.5 psig; discharge is 6 psig. Inlet temperature is 211°F; discharge, 288°F.

The compressor was designed of special materials in co-operation with Badger and government efforts to apply aluminum to saline water conversion stills. This makes it exceptionally compatible with the plant and aids in keeping over-all weight at a minimum. It is V-belt driven by a gasoline engine. As a point of further co-operation between the compressor supplier and the still manufacturer, the Axi-compressor was given opposite rotation from standard models to fit with the compact design and to match the engine rotation which could not be changed.

Brine at 106° F is drawn from the bottom of the evaporator, passed through the 3-stream heat exchanger, and flows to waste at 101 gph. Distillate at 97° F is pumped at about 2.5 gpm (at 50-psig total dynamic head) to the exchanger too, where it also gives up some of its heat to the inflow. Distillate flows to storage at 125 gph.

* Figures in this section are taken from June 1961 shop tests

As tested, the vapor compression still used a gasoline engine driver for all pumps and the compressor. With minor design changes, notably in the location of the engine, diesel drive is possible. The gasoline engine, manufactured by Continental Motors, is a 4-cylinder, 4-cycle liquid-cooled machine with speed governed at 1800 rpm. It is equipped with a 24-v, heavy duty electric starting system, and with a radio-interference supression kit. Fuel consumption is 8.2 pounds per hour; the water-to-fuel ratio is 147-to-1 by weight. Approximately 1.5 gallons of feed yields 1 gallon of pure water. Cost is a reasonable $1.25 per 1000 gallons.

The engine cooling system is of the vapor-phase or ebullient-cooling variety. Hot water circulates through the engine jacket, exhaust manifold, exhaust gas cooler and then flows to an overhead tank where a portion flashes to steam. This is used as a heating medium in the distilling system proper. The Badger exhaust gas cooler is of the shell-and-tube type, constructed of stainless steel. The engine water cooler, on the other hand, is of aluminum.

The entire still is about 14 x 8 feet, and stands 8 feet high. It weighs 6000 pounds, including the trailer, and is so balanced that it can be lifted by, say, a helicopter, from a single hook. The 2-wheel trailer mounting helped stipulate the size of the distiller. It is equipped with a canopy consisting of aluminum supports and top with canvas side curtains and has a 20-gallon fuel tank. Future models may be constructed so as to further reduce the over-all weight.

According to a report from the Corps of Engineers, distillation equipment became a major requirement after the beginning of World War II. Today all services recognize the potential requirement in the event of a major conflict. True, economy of operation has increased rapidly, but three problem areas existed, even on the best equipment: (1) considerable weight per pound of distillate capacity; (2) copper and nickel alloys used as construction materials; and, (3) rapid scaling and difficulty in cleaning. The Badger portable still eliminates all three.

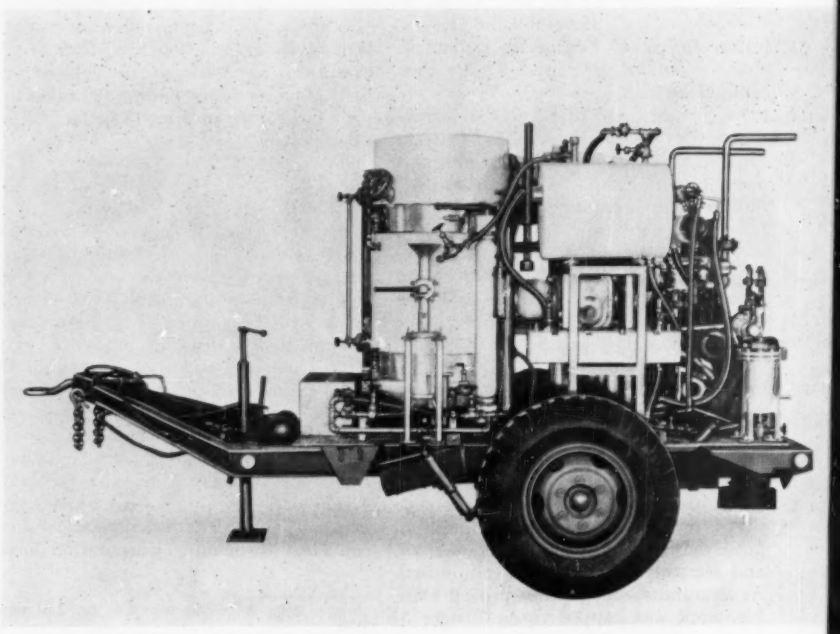
One prototype distiller was tested at Wrightsville Beach, N. C., in March and April 1958. The test lasted 713 continuous hours. Then in May through July of the following year, a 1469-hour test was conducted at Daytona Beach, Fla. The present unit was completed in May 1961 and was shop tested in June. From Cambridge it went to Fort Belvoir, Va., home of the Research & Development Laboratories, for field trials. It is now on a test program including field and troop tests. (Troop tests are designed to see how the unit will function while operated by military personnel under field conditions.)

How pure is the water? No matter how contaminated the intake, the distillate is pyrogen-free, meeting USP requirements for pharmaceuticals. Output is guaranteed to contain no more than 4.27 parts per million. There are several reasons that make this high purity feasible and economical.

One is the ease and efficiency with which it can be kept free from scale—always a major difficulty in thermal distillation. Scale formation is substantially reduced. How? Citric acid. It is simply added at intervals during the process. (During a 1700-hour test, it was added every 50 hours. Once units had to be shut down every 250 hours for scale-cleaning operations.) This stable, readily available, nontoxic white powder is instantly soluble in sea water. It is batch-injected into the sea water stream without disrupting the distillation cycle. Not only is citric acid nonhazardous to operating personnel, it has no effect on metal surfaces of the still, while at the same time it eliminates magnesium scale. As tests showed, addition of the acid means the still can operate continuously at or near peak efficiency. Badger reports a nearly 99-percent efficiency, even at low horsepower.

After 713 hours of operation during the Wrightsville Beach test, the evaporator tubes were "clean and bright with no evidence of corrosion." In fact, the only corrosion was on the evaporator tube sheet within areas close to and under flange gaskets. These trouble spots have been corrected in the manufacturing process of the present unit.

From the second test, at Daytona Beach, results showed conclusively that an aluminum sea water distillation plant for military use could be built. The present Badger still, tested at Fort Belvoir, is the proof.



PORTABILITY At left, the vapor compression still is shown as it would look dangling from a helicopter. Note the aluminum and canvas cover that is provided. With the cover removed, the view at right shows the unit ready for action.

JUMBOS | For a Mammoth Tunnel

Robert J. Brown, Jr.

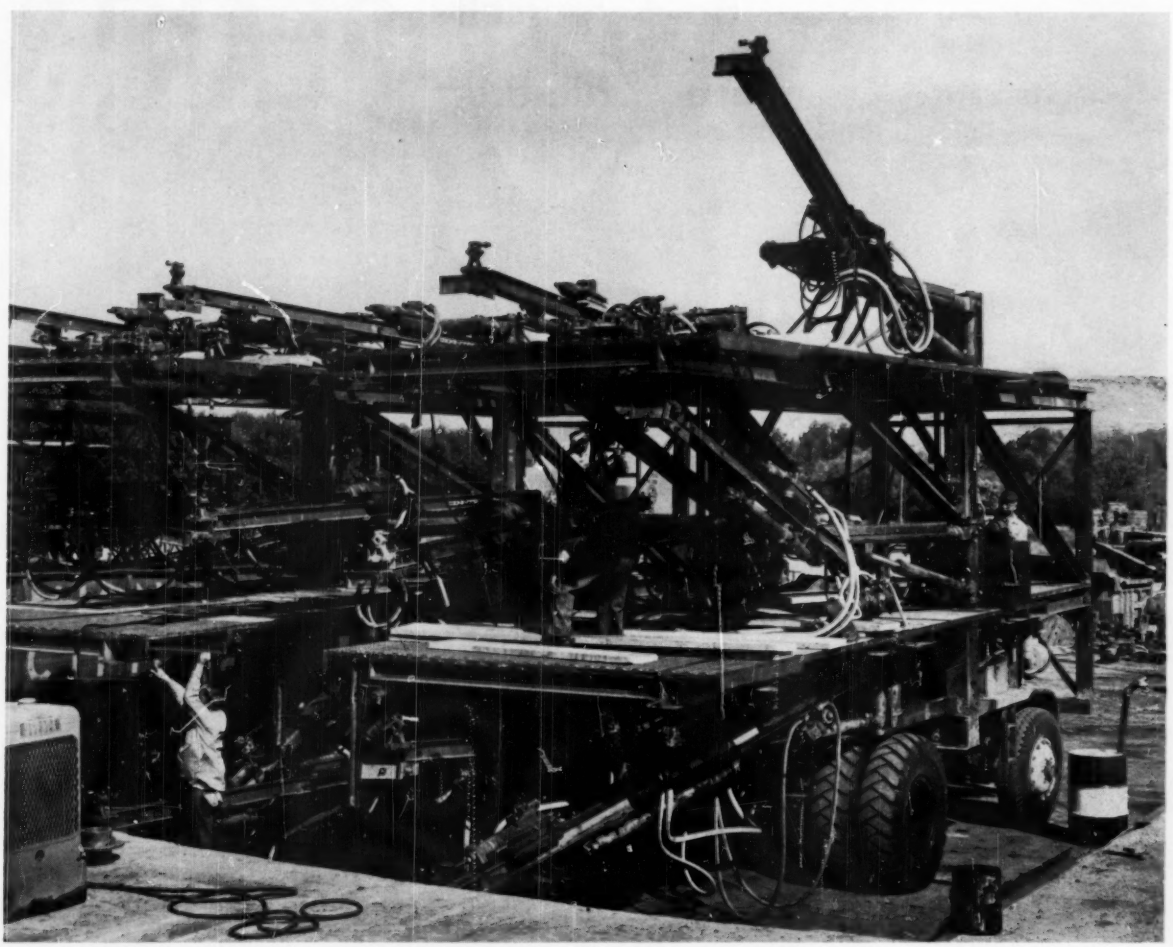
GROUND was officially broken on October 18 for the highest and largest concrete structure on the Missouri River Basin Project system—Yellowtail Dam, 45 miles southwest of Hardin, Mont. The dam was first proposed in 1916 by General George W. Goethals, builder of the Panama Canal. Through perseverance, the dream is coming true.

Backing up the Big Horn River 70 miles beyond Kane, Wyo., the reservoir will store 1,375,000 acre-feet of water with a maximum surface area of 27 square miles. Closure and first storage is scheduled for the fall of 1965. Water stored behind the dam will irrigate lands on the Hardin and Yellowstone pumping units of the Missouri River Basin Project, most of which is now dry-farmed. In addition to major irrigation, the unit will provide flood control and hydroelectric power, as well as fish and wildlife and recreational benefits. 1966 should see the first turbines and generators installed for the start of hydropower. The rated capacity is to be 200,000 kw.

The 520-foot-high bulwark and powerhouse are being built under a nearly $40 million construction contract awarded last spring to a joint venture of Morrison-Knudsen Company, Inc., The Kaiser Company, Perini Corporation, Walsh Construction Company, and F. & S. Contracting Company. M-K is sponsor, and the joint venture is known as Yellowtail Constructors. P. J. Soukup is project manager.

The dam will be an arch-type structure, 1450 feet wide at its crest. Approximately 1,770,000 cubic yards of concrete will go into the dam, powerplant and diversion tunnel. Preconstruction work was been underway at the damsite for several months. The photograph shows two truck-mounted drill jumbos each equipped with six Ingersoll-Rand D45 ($4^1/_2$-inch bore) drifters. The jumbos are mounted on 27 FD Euclid trucks and were especially built in M-K's headquarters shops. They are seen here being readied for rail shipment to Yellowtail.

These jumbos work side by side to drive a 2000-foot-long tunnel. M-K is using $1^3/_4$-inch carbide-insert bits on $1^1/_4$-inch steel. The intake portion of the tunnel will be 860 feet long. It is being driven to a diameter of 32 feet and concrete lined to 28 feet. The remaining section, approximately 1140 feet, will be used to carry diversion, but when there is no longer a need for this, will become the spillway section. It is being driven to a diameter of 37 feet and will be concrete lined to 32 feet.



do-it-yourself carbon dioxide PLANTS

A. L. Trumpler

MOST people know quite a bit about carbon dioxide. Almost everyone is aware that it forms about 0.03 percent of the air around us, and that it is a food for plant life and a waste product of animal life. A lot of folks also know that the average adult produces and exhales about 900 grams of CO_2 per day, that the bubbles in beer and soft drinks are carbon dioxide, and that dry ice is actually CO_2 in solid form.

What few people know about CO_2 (often called carbonic gas) is that its production and sale is a vast industry. Production in the U. S. alone in 1962 is likely to be well over a million tons—2 billion pounds. On a world-wide basis, this figure is a great deal higher because carbon dioxide is produced to a limited extent in many parts of the world.

Where does all this CO_2 go? According to a recent survey, solid CO_2 (dry ice), which is a chilly —109° F at atmospheric pressure, accounts for something less than half of the total, being used as a refrigerant or as a chilling agent in cold storage and shipment of ice cream, frozen foods and perishable food products, and in many other ways not only in the food industry, but in rubber and metalworking and a great number of other manufacturing fields. Its use is particularly advantageous because it doesn't melt into a liquid, like water ice, but simply evaporates into dry gas.

Liquid and gaseous CO_2 have literally hundreds of uses: for beverage carbonation, in fire extinguishers, for purging flammable and explosive containers and piping systems, in welding, and in chemical reactions, drugs and pharmaceutical products, for canning and packaging of food products, in aerosol packaging, and for humane animal slaughtering.

By far the majority of all this carbon dioxide has been produced over the years by a relatively few large producers who distribute and sell CO_2 as dry ice, as liquid (delivered by refrigerated and/or insulated tank trucks to the ultimate users' liquid CO_2 storage tanks), and as pressurized gas in high-pressure metal cylinders, usually containing 50 pounds of gas each.

One reason CO_2 manufacture has been restricted to the few large producers is that it had, until recently, been generally restricted to large-capacity chemical plants that were built to order, assembled on the job site, and were quite complicated in their operation. Like most large chemical facilities, they required full-time, around-the-clock operators. Very few large CO_2 consumers have produced their own.

Louis DeMarkus Corporation, Buffalo, N. Y., decided several years ago that the steadily increasing world-wide market for carbon dioxide offered a vast potential for a standard line of automatic, packaged, pretested CO_2 manufacturing systems that could produce pure CO_2 for one third to one twentieth of the normal market price, delivered

Opposite can be seen the components of a typical 150-pound-per-hour carbon dioxide plant. It is operating in Georgetown, British Guiana; the product is used for carbonated beverages as well as industrial uses. At left is the carbon dioxide generator; purification and liquefying system is at right. Not shown is the carbon dioxide storage tank.

to the point of use. The company was an old hand at CO_2, having led in the manufacture of collecting, purification and liquefying systems for 25 years. It was also accustomed to selling to a world-wide market. It was apparent to DeMarkus' management that high CO_2 costs in Latin America, for example, offered specially ideal markets for "do-it-yourself" CO_2 plants. Gas process engineers, therefore, designed and developed a line of packaged plants to fill the need that seemed to exist. In 1958, these plants were put on the market. Their success is evidenced daily.

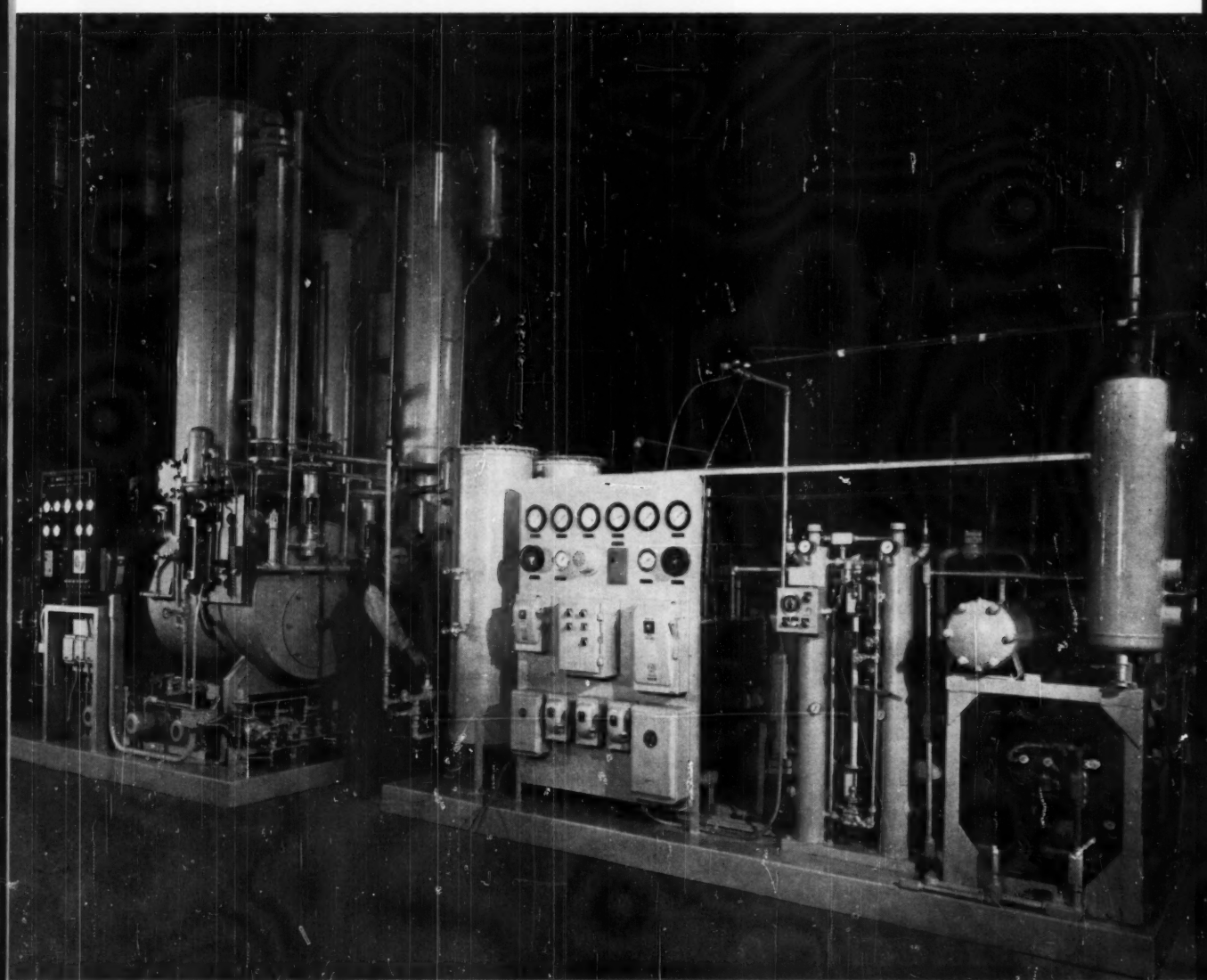
The plants utilize the latest amine absorption process. In this, fuel oil or natural gas is burned with air to produce a flue gas rich in carbon dioxide. Cooled flue gas is exposed by countercurrent flow in an absorber tower to a cool aqueous solution of monoethanolamine (MEA), a chemical having the unique characteristic of selectively absorbing carbon dioxide from any gas stream. The MEA solution containing the CO_2 is then heated to a temperature at which it releases its carbon dioxide. The CO_2 gas is next cooled, purified in scrubbers to remove all of the MEA and other trace impurities, filtered through a bed of activated charcoal, compressed to 250 psig, dried in a desiccant-filled dehydrator, and finally liquefied by mechanical refrigeration and stored as a liquid in a large, insulated pressure vessel at −10° F under 250-psig pressure.

Although this process is proved and common to most modern CO_2 production, DeMarkus engineers designed some unique features not generally available. Most important for "do-it-yourself" operation is a set of completely automatic controls that enables the equipment to be operated with only part-time observation and the attention of only one man.

Another feature is that the system is operated at lower pressures than most, thereby providing longer equipment life and less maintenance. Spare pumps and CO_2 compressors are included with each system to insure continuous operation should pump or compressor failure occur—a fact particularly significant to foreign customers. CO_2 is condensed by a flooded refrigeration system, with the refrigerant being condensed with ordinary cooling water instead of at high (1200 psig) pressures.

Another feature is the large-capacity DeMarkus liquid CO_2 storage system (usually 10–50,000 pounds) that operates at 250 psig, instead of the 1200 psig typical of older high-pressure systems. This permits storage of large quantities of liquid CO_2 for any emergency. It also reduces the explosion hazard in the vicinity of the storage tank.

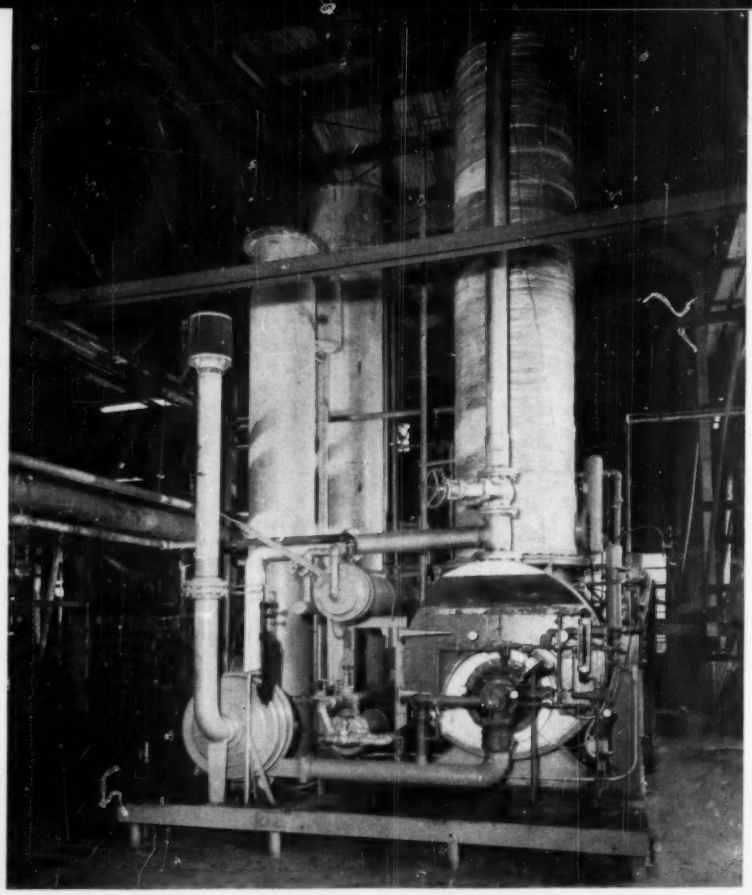
DeMarkus has succeeded in standardizing its line of plants to include five standard models from 50 to 500 pounds per hour capacity. However, the com-

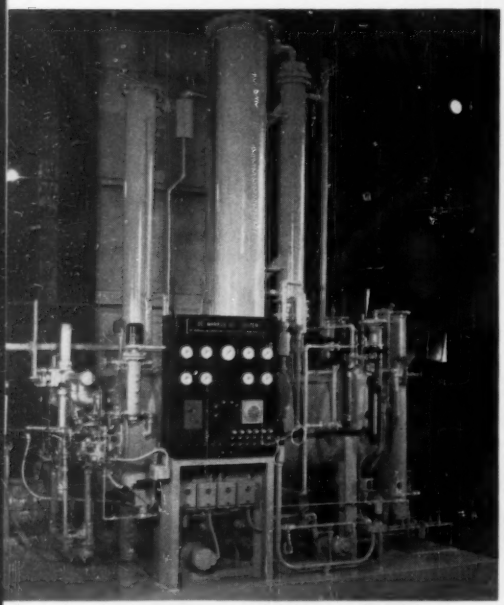


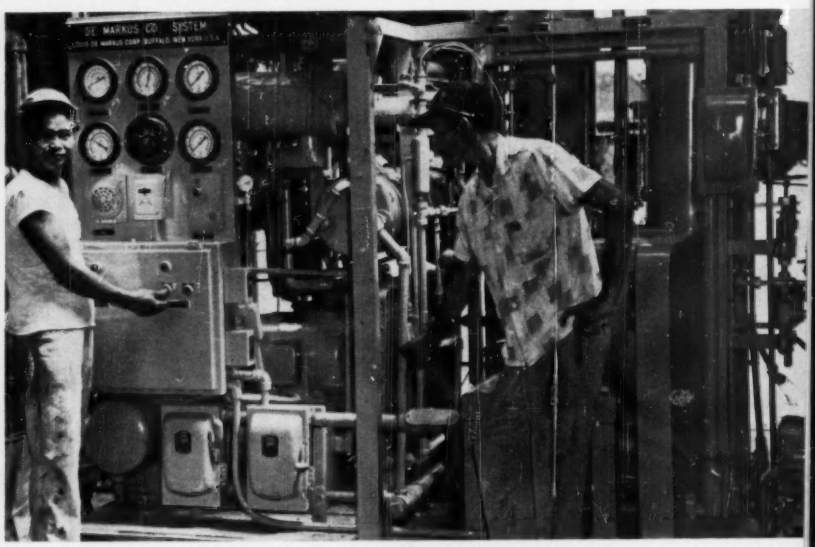
pany also builds larger units to any size—a 1000-pound-per-hour CO_2 generator for a New York State carbon dioxide distributor, for example.

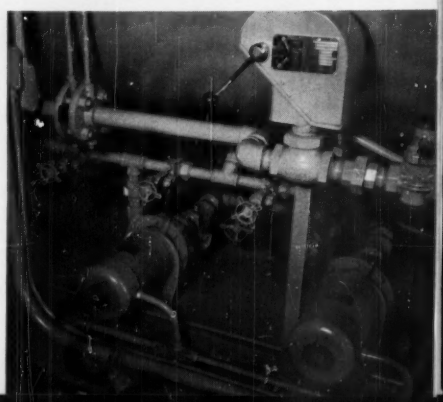
Perhaps one of the most difficult hurdles to be overcome is that of convincing large CO_2 consumers that the plants are easy to operate, not requiring trained engineers as many chemical plants do. To this end, the firm's engineers have adopted a continuing technical service program that includes analyzing plant performance from log sheets, analyzing samples of MEA for proper chemical control, and the like, for an indefinite period after each plant goes into service.

In the short time that DeMarkus has been marketing CO_2 plants, it has shipped them to Canada, Mexico, South America, the Philippines, and the Pacific islands of Kwajalein and Guam, to Malta and to Hawaii, Alaska and continental U. S. A few unique and interesting uses to which they are being put are in fire protection systems at missile bases, for inert purge gas for a nuclear power reactor, and in the production of one of the new wonder metals, lithium.





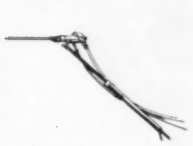




PACKAGED PLANTS Top right, first of two 500-pound-per-hour carbon dioxide plants erected in San Miguel Coca-Cola plant, Manila, P. I. The photograph shows the boiler and air intake end of the generator. The large tower on top of the boiler is a stripper column in which carbon dioxide is separated from the amine solution. Center right, Island Equipment Company's installation on Guam provides carbon dioxide for Pepsi-Cola, Coca-Cola and Seven-Up bottlers, as well as for fire extinguishers and the Guam Navy Base. It is a 100-pound-per-hour plant operated by native personnel. Above, a 50-pound-per-hour generator provides inert, nonabsorbing purge gas for a 200,000-kw, Atomic Energy of Canada, Ltd., nuclear reactor. Right, a close-up view under a boiler showing a typical pair of amine pumps. These are Ingersoll-Rand 1KRVS 1 1/2E Motorpumps in MEA-pumping service. They are rated at 20 gpm against a 75-foot total discharge head. Each is a single-stage, single-suction, vertically split centrifugal unit. They are installed on a 150-pound-per-hour plant that is scheduled for shipment to Barbados.

Preventive Maintenance for Rock Drills, III

√ Chucks
√ Operators
√ Shanks
√ Dirt
√ Side Rods



THERE are many major causes of rock drill operating difficulties besides the main culprit, lubrication, discussed last month. The other most important ones include: (1) worn chucks; (2) operator misalignment of drill steel with drill; (3) use of out-of-standard drill steel shanks; (4) dirt in the drill; and (5) neglect in keeping side rods tight and at equal tension. This article will tell about these difficulties and explain how intelligent preventive maintenance can eliminate them to increase the life of rock drills.

Worn Chucks

Correct alignment of the tool with the steel cannot be maintained with a bad chuck—the component whose job is to hold and correctly align the steel. If a worn chuck is used the steel will present an angle to the blow of the piston or tappet, and the steel shank won't be struck squarely. Broken steels or chipping of the shank will result. The end of the air or water tube may be shorn off or beaten closed. The steel being hit at an angle puts side stresses on the piston and rifle bar, and rotation is impaired. All this means poor drilling efficiency and increased maintenance.

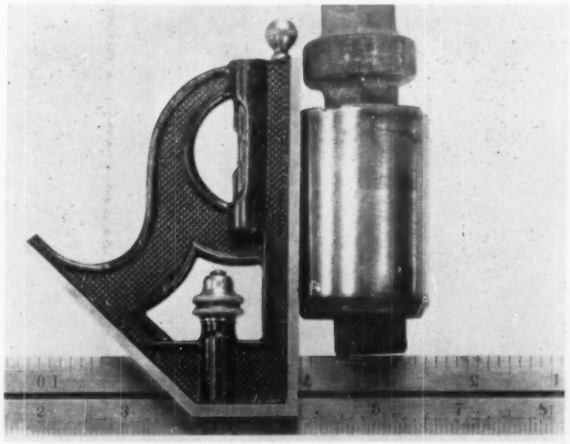
The best insurance against such losses is frequent inspection for wear and replacement of bad chucks. Some manufacturers furnish a gauge or template for measuring chuck wear. When one is not available, hexagon and quarter-octagon chucks can be tested by inserting a good steel into the chuck. The fit should be snug and the steel should be held in alignment with the piston extension. An excessively worn chuck for round lug steels will damage the lugs and is recognized by notches formed on the ends of the chuck bushing and rotating chuck. The diameter of the chuck opening can be checked by using a "go, no-go" gauge.

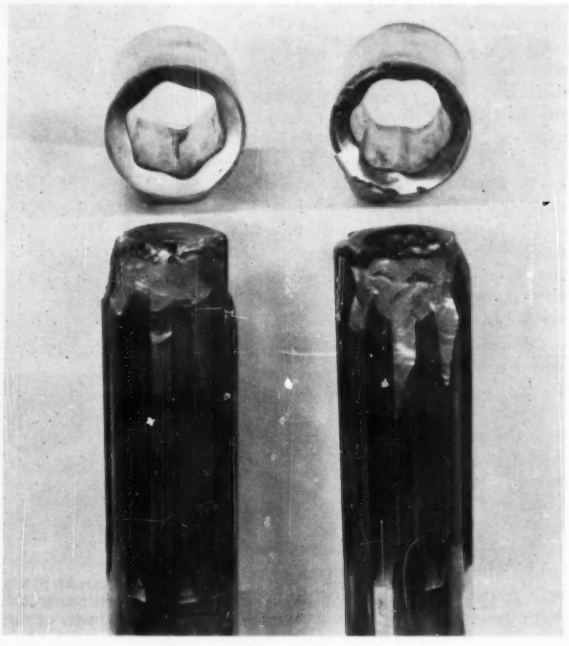
Operator Misalignment

Drill jockeying, in general riding the drill with a steel through the handle, and loosening saddle clamps on mounted machines harm drills by cramping working parts. The resulting side strain produced by these misalignments is a common cause of excessive rifle bar and rifle nut wear and will often crack or break the parts. Misalignment slows the piston, reduces the force of each blow and can cause scuffing of the piston in the cylinder. (Misalignment in the front head also produces chuck wear and allows the piston to strike the steel shank at an angle.) Maintaining machine alignment with the drill steel is a simple but highly important preventive measure that is the responsibility of each driller.

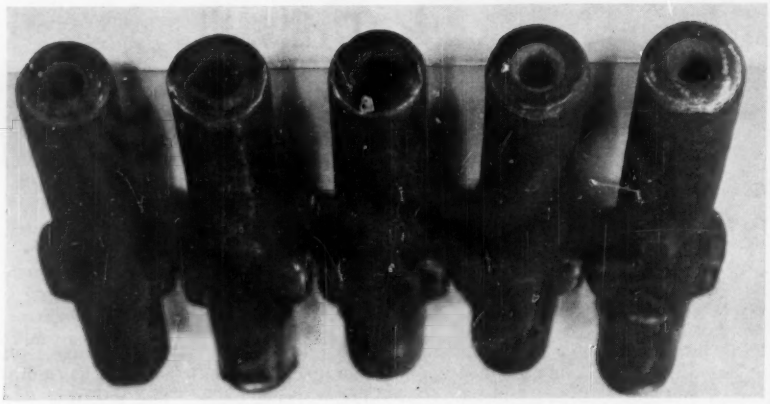
Out-Of-Standard Shanks

Inspection and prompt repair of drill steel shanks is as important to rock drill performance as replacing worn parts. Out-of-standard shanks cause damage to bits and working parts. It can be said that a shank is out-of-standard if it does not meet all the following requirements:





CHUCK TROUBLES The use of worn chucks, even with properly made shanks, can result in damage to pistons, much more expensive and difficult to fix than the simple replacement of the chuck. The picture of the correctly made shank fitted into a worn chuck shows why: the piston cannot strike the shank squarely. The result of the high impact loads on a limited area is shown in the view at the right. Use of wear-limit, or discard, gauges would prevent this condition.



CROWNING **Improperly made shanks are shown in the picture at left. Highly crowned and excessively beveled around the perimeter and into the water hole, they result in piston damage such as that shown at right. Again, the powerful stroke of the drill concentrated on such a small area is the reason for the spalling shown. Excessive hardness of the drill steel shank can also be a contributing factor.**

A flat and square striking end — This is essential to prevent piston damage. A crowned shank reduces the area of contact between the shank and the striking face of the piston so that the piston's blow is highly concentrated. The piston's striking face then chips and cups rapidly. Such off-square shank ends also have a small area of contact with the striking face of the piston and frequently chip or spall it. As shanks become crowned in normal service, they should be checked and brought back to standard.

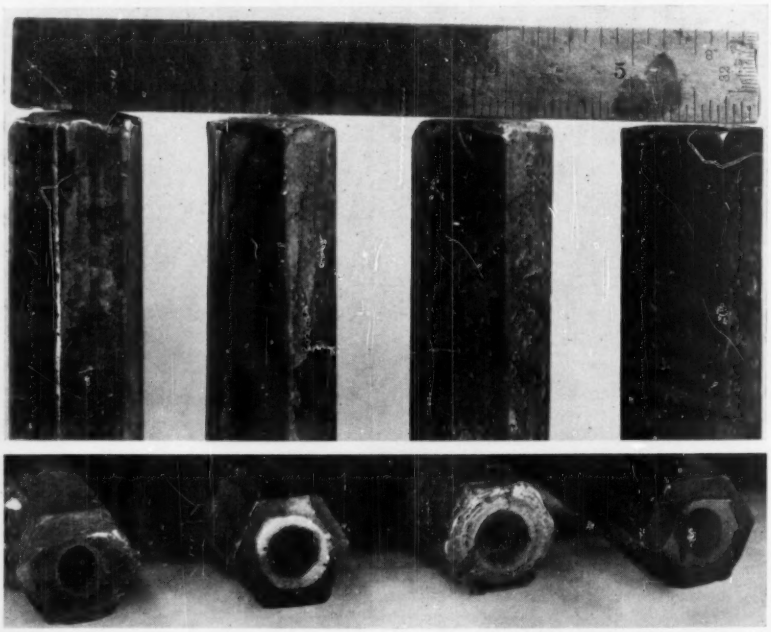
Properly formed collar or lugs — The end of the chuck or chuck bushing receives the impact of the rebounding drill. If battered lugs or collars are used they will damage the chuck. Misalignment during drilling tends to further increase damage. Shanks, lugs and collars must be within tolerances for shanked steels; if not, they should be discarded or reconditioned. Also, shanking dies should be checked frequently to be sure they are within limits.

Correct length from collar to striking end — Shank ends that are overly long extend too far into the chuck and cause short stroking of the piston. Loss of drilling power and premature shank breakage result. If the shank is too short, long stroking occurs and the piston's blow is partially absorbed by the air cushion. This results in low drilling speed and may overheat the front end. If front head parts are so worn no cushion is present, a short shank will allow the piston to strike the buffer ring full force and the piston will probably break. Shank gauges are available for checking length from under the collar or lug to the striking face. Use them.

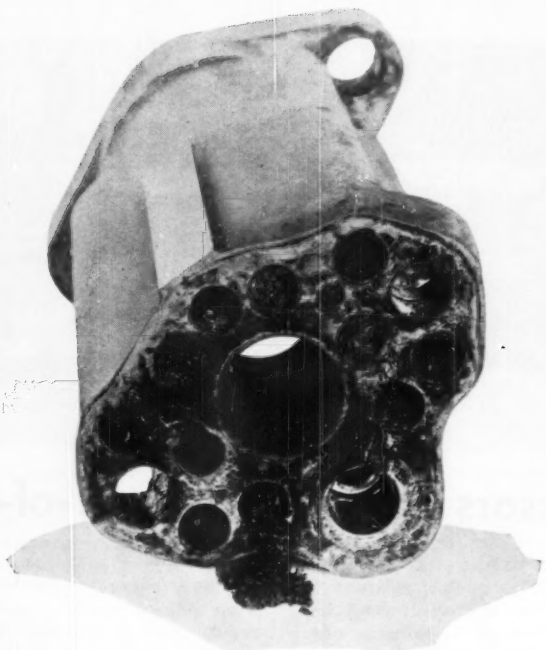
A center hole that is clear, punched and chamfered — A plugged center hole will restrict blowing action and interfere with hole cleaning. In wet drilling, a plugged hole may flood the drill and wash away lubricant. When not enlarged by punching, or not punched deep enough, lack of clearance for the water tube may cause the shank to batter the end of the tube closed. The sharp edges of an unchamfered center hole may damage the water tube. Before using each drill steel, check to see that the hole is unobstructed, enlarged or punched on the shank, and chamfered.

Correct temper — Shanks that are too hard cause chipping of the steel and small particles of metal become imbedded in the piston striking face or work their way in to score the cylinder wall. A shank that is too soft will be battered from the constant pounding and may rivet itself in the chuck. The shank must be tempered hard enough to absorb the piston blow but softer than the striking end of the piston.

Correct size — An undersized steel shank will have a poor fit in the chuck and contribute to premature chuck wear. It will also damage the piston striking face due to poor alignment. Blowing power and over-all performance will be reduced when a small shank is used since



RESHANKING NEEDED **Two views of the hex steel above show wear and tear that will result in early failure of pistons if this steel is used in drills. The steel is a working part of the drill and should be kept in good condition.**



DIRT The drill from which the above cylinder was taken was returned to the drill doctor's shop because it "had low power." It is a wonder the drill ran at all. The particles seen clogging the ports are nothing more than deteriorated rubber from a worn out hose. The best way to handle such cases is to make sure hoses are in good condition and dust and dirt kept out of lubes and lines.

it will permit air to escape between the chuck liner and the shank. An oversized shank may wedge itself in the chuck or even split it. Check shanks frequently and discard or recondition those of incorrect size.

Dirt In The Drill

Keeping a drill free of dust and dirt is difficult. They should, however, be kept as clean as possible. A little effort to prevent foreign matter from entering them will pay off.

Abrasives enter a rock drill in three ways: as particles in the air from the compressor, or as pipe scale or flakes of deteriorated rubber from air lines; as dirt picked-up when the drill is dropped in muck or as a result of the tool being left in the blast area; and, as dirt in lubrication oil.

Impurities from the compressor can be reduced by air intake filters and by locating the compressor in as clean an area as possible. Lines to the drill should always be blown out to keep them clean. Another way to minimize danger to the drill is installing a strainer in the air hose in front of the line oiler. This will catch coarse solids and pipe scale. Some drills have fine wire screen strainers in the goose neck to do the same job but operators occasionally remove them, complaining they impair efficiency. This is only because they aren't serviced regularly. Air strainers and filters are excellent insurance against excessive rock drill wear and should be cleaned at intervals.

Drills, particularly those tools left near blasts, are often returned to the shop for repair because they are simply too full of dirt to run. When drills can't be moved a safe distance away before blasting, they should at least have their chuck openings, and inlet and exhaust ports plugged.

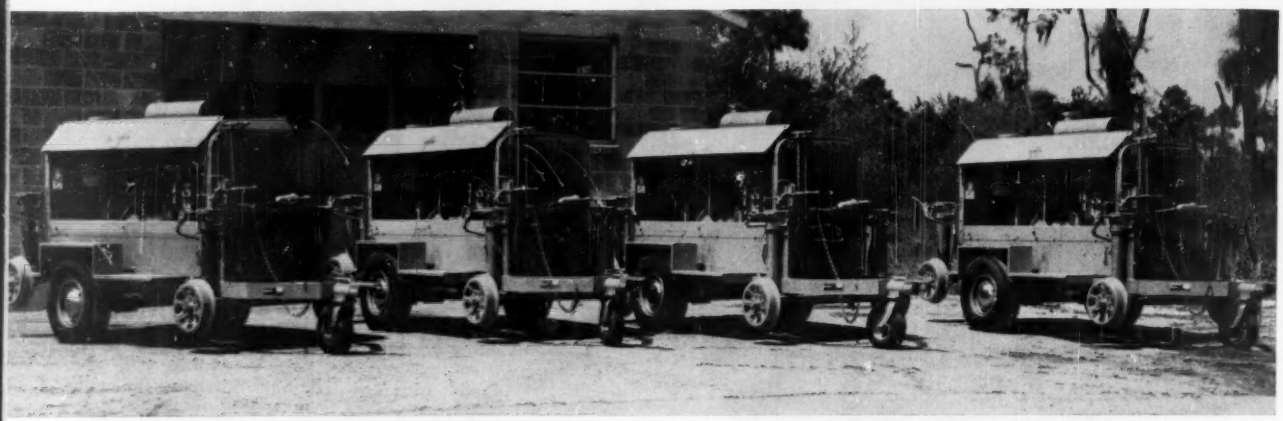
If at all possible a drill should be sent at regular intervals to the shop for complete dismantling and cleaning. If this can't be done, a reasonable job can be carried out by flushing with kerosine or another solvent. After flushing, pour a few ounces of rock drill oil in the air inlet and run the tool briefly at low throttle.

Loose Side Rods

When side rods are loose, excessive play causes wear and misalignment. Strains develop and broken parts result. Loose side rods also allow air leakage between backhead and cylinder and the cylinder and chuck housing, and often strip threads on the rods. Uneven tension on the rods frequently causes the tighter one to break just behind the nut. The misalignment that results from unequal tension harms rotation and can progressively wear the buffer ring until the protective air cushion between piston head and the ring is destroyed.

The remedy, of course, is to keep rod nuts tight and at equal tension. The nuts should be tightened once a shift with the wrench made for that purpose. On drills having side rod springs, weak or broken springs will cause cramping due again to the uneven tension on side rods. Replace weak or broken springs with new ones. When their nuts are tightened, tension on each should be equal and care should be taken to see that the coils are not completely closed.

JOCKEY This rider will never win. Jockeying a drill in this fashion can throw it out of alignment and cause damage as described in text.



Self-Propelled Compressors for Maintenance-of-Way

C. H. Vivian

SINCE about 1915 the nation's railroads have used portable rail car air compressors for various services. The first ones powered pneumatic tie tampers, which replaced hand-wielded picks and forks and vastly speeded and improved ballasting of track—the most expensive operation in track maintenance, but also an indispensible one. Gradually more air tools, such as woodborers, spike drivers and spike pullers, railbonding wrenches, etc., appeared and were accompanied by compressors that grew better in design and came in a more complete range of sizes.

By and large the established compressor manufacturers have always adequately supplied the needs of the rail lines, but occasionally an alert and enterprising specialist in some phase of maintenance-of-way operations has seen and acted upon an opportunity to add something to conventional equipment that increases its usefulness. In that category is Roy C. Patton, a small manufacturer of railroad equipment and supplies who does business under the name of Roy C. Patton Co.

The latest product to come from his shop in Jacksonville Beach, Fla., is a self-propelled portable compressor that can travel on either rails or the highway. It can be moved as desired, while working, by any member of the gang operating the tools for which the compressor supplies air. In addition to four 16-inch flanged steel wheels at the corners, as is usual on rail cars, this unit also has three pneumatic-tired wheels. Two of the latter are mounted on a transverse axle about midway of the unit and have tires of 7.00x15 truck size. Flanged and tired wheels are of the same gauge—that of standard railroads.

IN VACATION SPOT **Four machines (above) in front of Patton's shop, Jacksonville Beach, Fla. They are shown resting on their three pneumatic-tired wheels, the four flanged steel wheels being retracted. Patton formerly operated at Charlotte, N.C., but moved further south for reasons of health 14 years ago. His factory, though small, is about the only industry in the community, which lives strictly for tourism and recreationists. Below, flanged rail wheels and small pneumatic-tired wheel in front are raised so full weight is on the two large central wheels when the unit is towed over highways. Speeds to 50 mph are safe.**

The third pneumatic wheel is a small one, centered in front. There is a drawbar for towing by truck over a highway. When this is done the flanged wheels are retracted. The tow bar is adjustable to fit various pulling vehicles. The carriage can be towed with safety at speeds to 50 mph. When a stop is made and the towing vehicle detached, the weight that had been borne by the tow bar while in transit is transferred to the small wheel.

When on rails, the car is propelled by an Ingersoll-Rand Multi-Vane air motor at speeds to 25 mph, either forward or backward. The motor is mounted on the front of the car and develops approximately 5 hp at the air pressure usually used on this type of work. Power is transmitted to one of the flanged wheel axles through a roller chain and sprocket drive mechanism.

Both the flanged wheels and the pneumatic wheels are in contact with the track. The latter bear all but about 8 percent of the weight—this is because they provide better traction and are equipped with electric brakes that operate either on the rails or highway.

The ability to move the car quickly by remote control while it is at work makes it unnecessary for anyone to be stationed at the car or to go there each time a move is to be made. This substantially increases the ratio of working time to shift time. The control system, which was designed by Patton, includes a special graduation feature that permits propelling the car at very slow speed. The system also has some foolproof safety features to prevent workmen from being run down.

The exact number of tools to be oper-

ated will vary according to the type of tool. Assume, however, that four spike drivers are being run—two in front of the machine and two behind it, all with hoses about 20 feet long. When either pair has completed work on its allotted 20 feet of track, one of the workmen can signal to the machine to move by operating a 4-way valve on the air line. However, the machine will not make its move until the other pair has finished its stretch of track and has also signaled. This prevents shifting before the scheduled work is completed and eliminates all possibility of an accident befalling either group of workers. The automatic brake is applied when either valve in the hands of the workmen is placed in neutral.

Where the track being worked is "live," that is trains are being routed over it, work must stop and the equipment be removed from the track to allow the train to pass. The pneumatic tires aid in doing this. However, most railroads now have a crane standing by to lift the compressor unit off the track and return it after the train has passed. With such handling in mind, a bale is included on each Patton machine.

The compressor is a standard Ingersoll-Rand Gyro-Flo portable of 250-cfm capacity, driven by a General Motors diesel engine. It is furnished as a skid-mounted assembly to Patton, who prepares the running gear and takes care of the mounting.

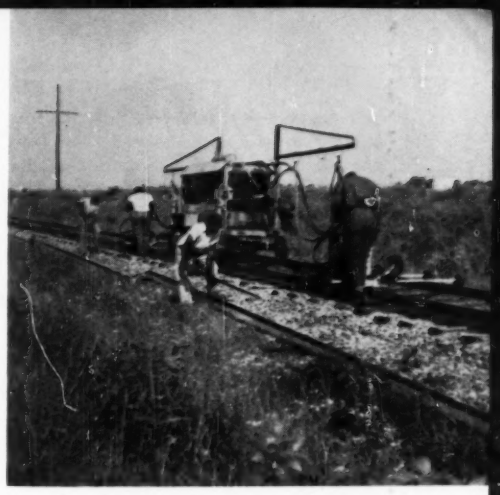
The first four Patton portable compressor carriages—as the manufacturer calls them—were sold to Seaboard Air Line Railroad Company and delivered at Hamlet, N. C. They are intended primarily for system-wide use by rail-laying gangs. Each machine operates two dual spike drivers—a total of four tools. Although the units were placed in service in 1960, they have so far had limited use because of road's reduced rail-laying program. Consequently no operating data or costs have been compiled, but Seaboard's chief engineer, T. B. Hutcheson, states that the Patton units have advantages not found in the equipment previously used for the same purpose.

Patton's product is an outgrowth of a previous piece of railroad equipment that also carries an air compressor. It is known as the B & B Sprayer, B & B standing for bridge and building. It sprays grease- or asphalt-type coating materials and paint by hydraulic pressure. Patton claims it will spray any liquid that can be poured, no matter how slowly.

His interest began when he was selling a bridge coating material made by Southwestern Petroleum Company. He felt that it could be improved, and formulated an All-Weather compound that he distributes nationally. It is made for him by a leading asphalt manufacturer and contains, among other things, an undisclosed quantity of asbestos fibers.

As a supplier of this material, he became interested in improving the equipment available for spraying it, and developed the B & B unit on which he has patents. For holding the material to be sprayed, this machine has two built-in metal compartments, which can be made into one by removing the partition between them. One 55-gallon drum of the material is placed on each side of the carrier. Each in turn can be picked up by a hand hoist and dumped into its proper compartment.

A 125-cfm diesel- or gasoline-engine-driven compressor is mounted on the unit. To reduce the viscosity of the spray material and insure that it will be of suitable consistency in hot or cold weather, provision is made for heating it under thermostatic control in the vats.

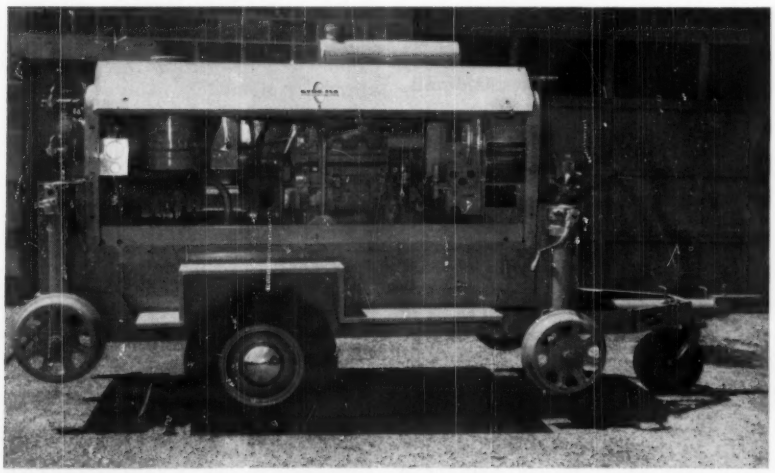


AT WORK On rail-laying operation for Seaboard Air Line Railroad, one machine furnished air for driving 64 spikes a minute.

The exhaust from the engine that drives the compressor is circulated through a chamber underneath each compartment; also the engine and compressor cooling water is circulated through a coil in the bottom of each compartment.

Patton advertises that his outfit will spray any suitable material at the rate of 8 gpm and that with his All-Weather material a bridge deck can be coated for less than $1 a lineal foot. The entire structure of a half-mile cantilever bridge across the Kentucky River at Lexington, Ky., was painted in 5 weeks by the Patton method. Hand brushing it had required 6 months and more men.

This earlier machine is self-propelled by the same size Ingersoll-Rand air motor as on the more recent one and is equipped with both steel and pneumatic-tired wheels. When not spraying the unit still has use. There is a manifold with four air hose take-offs.



STANDING BY With tow car detached, small pneumatic-tired front wheel is lowered and takes some of the weight. In the photograph at right, at the base of the radiator, is the Ingersoll-Rand air motor that propels the car when on rails.

this & that

Russian Grits Defective

Automation of production lines in Russian automobile plants, bearing factories and other manufacturing enterprises is being seriously hampered by the poor quality of abrasive tools, according to the U.S.S.R. periodical *Mechanization & Automation of Production*. The article points out that an inspection of one of the Soviet Union's largest abrasive tools plants revealed that more than 40 percent of the factory's output did not meet specifications. The article goes on to say that a "gigantic" amount of work must be done by Russian industry to meet the goals for mechanization and automation. The material from this article is available in English in a 28-page collection of six articles from Russian publications—*Soviet Metalworking Equipment; Selected Translations*—that may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. for $1.

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Air Blast Pulses Reactor

A new dimension is being added to nuclear engineering at the University of Illinois. The College of Engineering's TRIGA nuclear reactor is beginning to "pulse" up to a power level equivalent to 250,000,000 w. The pulsing capability was made possible by AEC permission and by a National Science Foundation grant of more than $51,000 for special fuel and controls. A "pulse" is a rapid brief increase in power level. In nuclear engineering jargon, pulses are measured in "dollars." A 1-dollar pulse is a change in reactivity equivalent to the amount of fuel that has to be added to a reactor operating at steady power output to permit a chain reaction with just the prompt or primary neutrons. The AEC has permitted the Illinois reactor to go to 2-dollar pulses. The pulse is not attained by suddenly adding fuel to the reactor, but rather by removing some of the "poison" or neutron absorbing material from the fuel already present. This is done by literally blowing one or more of the control rods out of the reactor with a blast of compressed air. The nuclear characteristics of the fuel limit each pulse to less than 1 minute. Pulsing the reactor gives it research capabilities of much larger units although the full potentialities are not as yet known.

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Shocks Preserve Milk

Swedish scientists have developed a method of attaining a completely sterile milk that can be stored at room temperatures for at least 4 weeks without loss of flavor, color or nutritional value. In the process, the milk is preheated and then given a shock treatment by being heated to 284° F by jets of hot steam, then quickly chilled by evaporation in a vacuum chamber. This vacuum processing also frees the milk of any feed or similar tastes. According to a Swedish government release, the process would be useless were it not for the parallel development of completely aseptic methods of filling into sterile containers. The process may revolutionize milk supply and distribution in tropical countries and may also be of considerable importance throughout European countries that already consume substantial amounts of autoclave-sterilized milk.

★ ★ ★

Checking Rabbits' Habits

Where does a rabbit go after dark? A talking bunny would probably say that it was none of your business, but two University of Illinois scientists have discovered a way to find out, bunny indignation or not. An electrical engineer and a natural scientist have been keeping tabs on rabbits' habits by radio. They have built tiny transmitters weighing less than an ounce to strap to an animal's back. A built-in battery keeps the transmitter going for as long as 4 months. Once equipped with one of the packs, the animal is tracked by direction-finding radio. On ducks flying $1/2$ mile high, the radio can be tracked for 60 miles; at ground level, it has a $1/2$-mile range. Research at the Illinois school has indicated that wild rabbits generally confine their rovings to a 2-acre area in any given night, although previous research disclosed that the bunnies may roam over a 6- to 8-acre range during a lifetime. The average rabbit awakes about 5 p. m., eats and starts his night-time rounds. About 7 a.m., he heads for home and bed.

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Cryopumping Generates Low Pressures

A scheme of vacuum pumping makes it possible to come even closer to the vacuums of outer space than with previous methods of gaining extremely low absolute pressures. The problem of obtaining high vacuums has been compounded in recent years by the need to test a variety of complicated equipment in the vacuum chamber. Often this equipment will "out-gas" or give off sufficient quantities of vapor to seriously effect the grade of vacuum that researchers are trying to maintain. Cryopumping is a technique for placing large panels cooled with liquid gases into the vacuum chambers. The panels act as pumps because most gas molecules that strike them will instantly freeze and stick, thus, in effect, being taken out of the chamber. Temperatures on the order of 20° K are being used. In some cases, panels of different temperatures will help do the job most economically. For example, panels at 77° K may be used to surround panels at 20° K. The lower-temperature cryopanels freeze out gases—the higher temperature ones shield the pumping panels from heat radiated by chamber walls or even the test object. Such devices are also used in low-density wind tunnels. The flow of gas molecules toward the cold surfaces of the cryopump panels takes place so rapidly and at such low pressures as to effectively simulate conditions of high velocity flight at the fringes of space. Pressures of the order of 10^{-3} to 10^{-4} mm Hg are utilized in these tunnels.

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Evaporation Water Loss Control

A major co-operative test of a chemical water-evaporation retardant on Sahuaro Lake in Arizona during 1960 achieved reductions in water losses of 14 to 22 percent. The test was the second in a series of major co-operative field experiments with methods of reducing evaporation water losses by use of chemical monolayer films. Results of the test were released early in October by the Bureau of Reclamation as the joint report of a committee of engineers and

scientists of the Bureau, the Public Health Service, and the United States Geological Survey. Sahuaro Lake is a 1260-acre reservoir behind Stewart Mountain Dam on the Salt River Reclamation Project near Phoenix, Ariz. Bureau officials indicated that much research work remains to be done to bring the costs of evaporation suppression down to a level at which the method would have practical, everyday use.

The Bureau of Reclamation applied and evaluated the chemical film. The Geological Survey determined the amount of water saved, and the Salt River Project provided the necessary facilitating services. Using a technique capable of measuring concentrations of five parts per billion of the chemicals in water, the Public Health Service was unable to detect any of the chemicals in samples taken from the dam's outlet works. The materials used were commercially available mixtures of hexadecanol and octadecanol—industrial chemicals used in such products as cosmetics, detergents and paints. They are derived from tallow, sperm oil or coconut oil, and are relatively tasteless and odorless. The chemicals were applied to the surface of the lake by a dusting technique utilizing blowers mounted in boats. The amount of material applied from October 19 to November 17—the period of maximum coverage—averaged 0.29 pound per acre per day. The first major field experiment was conducted in 1958 on the 2500-acre Lake Hefner—a reservoir serving the domestic needs of Oklahoma City—and effected savings of 9 percent in water losses under difficult conditions.

Terzaghi and Ferris VOTED MOLES AWARDS

Dr. Karl Terzaghi of Winchester, Mass., internationally known pioneer in soils mechanics, and George F. Ferris, board chairman of Raymond International, were named as the 1962 recipients of the awards given by The Moles for "outstanding achievements in construction."

Dr. Terzaghi and Mr. Ferris make up the 22nd pair of honorees in a series that started in 1941 and numbers among its winners former President Herbert Hoover, Robert Moses, Admiral Ben Moreell, Peter Kiewit, Harvey Slocum, John Bruce Bonny and Lou Perini.

The award is considered the highest recognition that can be accorded for service to the American construction industry. It is made annually to one member and one nonmember. Dr. Terzaghi is the nonmember winner.

George F. Ferris

Dr. Terzaghi, who was born in 1883 in Prague has had wide experience both in teaching and in the execution of significant engineering projects in Europe and in this country. He first came to this country in 1912 to study earthwork engineering data accumulated by the U. S. Reclamation Service, and worked as a driller on construction of the Celilo locks on the Columbia River. In 1916 he returned to Europe and taught at the Imperial School of Engineers in Istanbul, and it was while there that he developed most of the basic principles of modern soil mechanics.

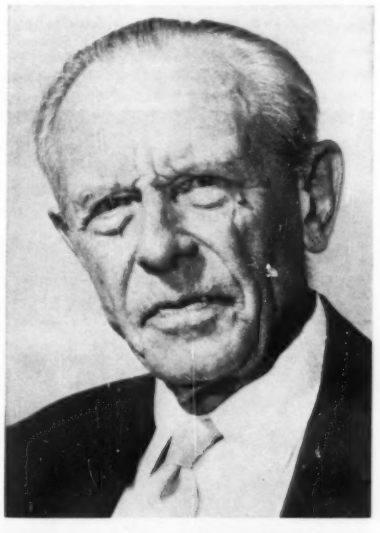
His teaching activities in the United States included two visiting lectureships —one at Massachusetts Institute of Technology in 1925 to 1929, the other at Harvard University in 1938. He became a United States citizen in 1939.

Some of the projects on which he served were: construction of the Chicago subway system; the subsidence of the City of Mexico for the Mexican government; construction of Kenney Dam for Aluminum Company of Canada; the Sariyar and Seyham Dams in Asia Minor; the Serre Poncon Dam across the Durance Valley in France; and the Aswan Dam in Egypt.

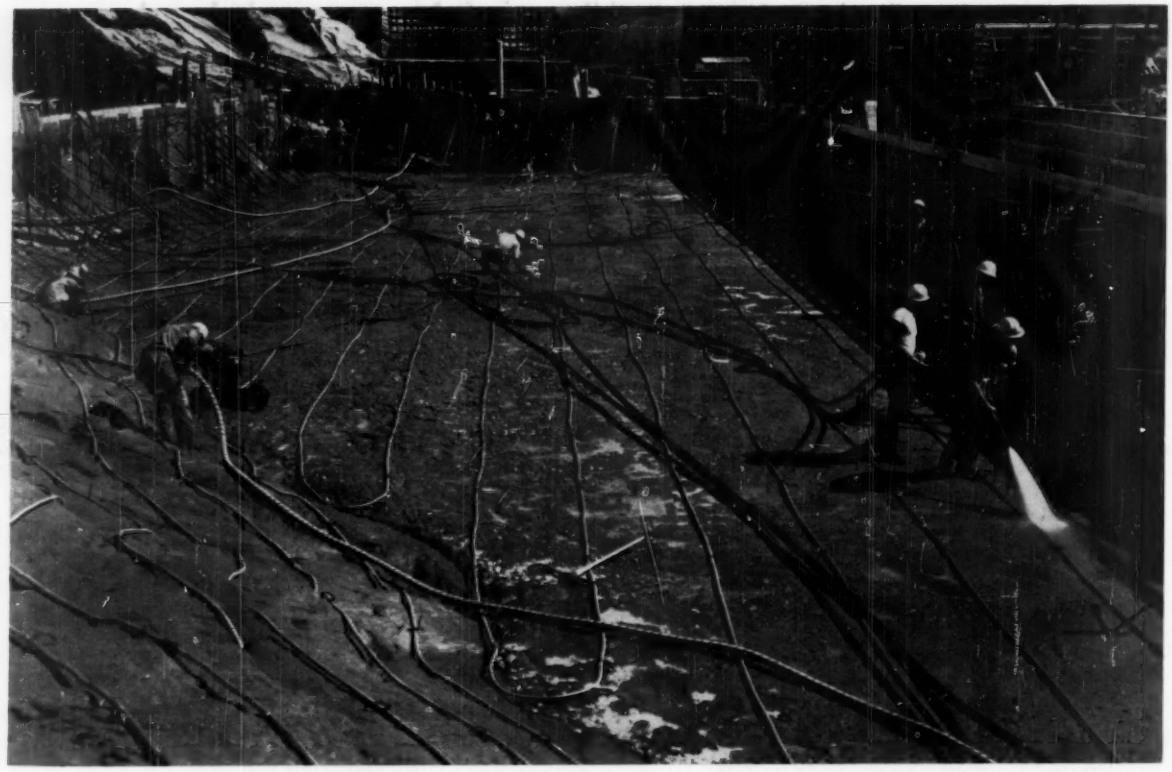
Mr. Ferris, a 1924 engineering graduate of the University of Florida, has been board chairman of Raymond International since 1960. After immediate post-college experience on land reclamation and marine construction in his home state of Florida, he came to New York in 1929 with the Turner Construction Company. For the next 10 years he served as superintendent on major projects in the New York metropolitan area, and in Maryland and Illinois.

For the next 5 years he was engaged in a massive program of air base construction for the Navy in the Pacific area. He marshaled the forces of American contractors and directed a program covering more than $3600 million worth of procurement, shipping and construction. He was given the Navy's Distinguished Public Service Award.

Mr. Ferris joined the Raymond Company (then known as Raymond Concrete Pile) in 1946; he was elected president in 1953, and board chairman in 1960. He played principal roles in organizing and managing the $350-million Spanish bases program, the huge Hyperion outfall project off Los Angeles, and the spectacular bridge-and-tunnel crossing of Lower Chesapeake Bay, now under construction.

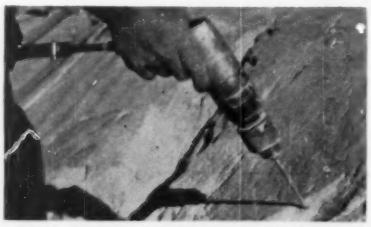


Dr. Karl Terzaghi



COOLING JOB Nine hundred miles of aluminum tube is imbedded in the concrete of Glen Canyon Dam, Page, Ariz. Water circulated through the tubing removes heat from the concrete, permitting it to harden without cracking. Tubing is later filled with grout.

AIR NOT ELECTRICITY In looking at the two photographs (below) of an Ingersoll-Rand 1AH Multi-Vane drill, it is obvious that the contractor could not use electric power. He was able to put down in sandstone a 5-inch hole, $^{3}/_{8}$ inch in diameter, every 10 seconds, and saved $17,520 on the entire job.



Pinning Problem Solved

PEOPLE outside the garment industry took as humorous the title of a novel of a few years ago—*7$^{1}/_{2}$ Cents*. To men concerned with repetitive production, such a figure is no laughing matter. It has special significance.

Seven and one-half cents—that is just about what one contractor handling a pipe-pinning operation at Glen Canyon Dam is realizing in savings per hole. With 240,000 holes, this amounts to $17,520 for the entire job.

Concrete for the dam must be cooled to aid in setting up the material. When it is considered that by volume of concrete—nearly 5,000,000 cubic yards—Glen Canyon Dam will be the third largest in the U.S., cooling is quite a chore. To do it in the lower portion, it was decided to force chilled water through aluminum tubes about 1-inch O.D. Prior to this, the concrete is cooled in the batching plant by the addition of chipped ice and chilled water. Then, after it is placed, water circulating through the tubing removes more of the heat of hydration, permitting the concrete to harden without cracking. When heat removal is no longer necessary, the tubing is filled with grout and left in the 710-foot-high bulwark.

Aluminum tubing, the use of which was pioneered during the construction of Williams Fork Dam near Parshall, Colo., in 1959, was used because of its estimated 30-cent-per-foot cost savings over steel tube. Because of its excellent uncoiling and bending characteristics, mechanical tube benders were not required. This also meant that a means had to be devised to hold the tubing in place. Steel pins are used here.

To position the pins, a $^{3}/_{8}$-inch hole is drilled 5 inches deep into the sandstone river bed. The steel pin is then driven into the hole; tubing is located, and the pin bent over to hold it in place. The contractor had to find the fastest method of drilling the holes in the rock.

Electric drills were out of the question because of the ever-present water. Rock drills were too bulky. An air drill seemed to be the solution and one was purchased. Running at top speed, though, it required 25 seconds to put down one hole. Finally the right pneumatic drill was found—a 1AH Multi-Vane unit. Time per hole was cut to less than 10 seconds. Cost per hole with the slower drill was 11 cents; with the 1AH it was 3.7 cents. Savings per hole amounted to 7.3 cents.

editorial

WINTER

NOSTALGIA seems to engulf the world this time of year along with thoughts of the "good old days." There's much about them, of course, that is worth being preserved such as the mood and spirit of the Holiday Season now upon us. There is also a standing argument that comes up as winter sets in and that concerns the relative severity between what we have today and what was in the "good old days."

We are probably going way out on a limb, but we would venture that at least a part of the moderation, if any, that we seem to experience today is because of certain modern conveniences. And, it's of interest to us to recall how compressed air and other gases serve in doing battle with King Winter.

The most obvious one is the growing use of gas for home heating. About 53 percent, (fully 27.7 million units) of the apartments and homes in the United States in 1960 were heated with gas according to a report of the American Gas Association, and the clean, even heat of the fuel certainly does a great deal to mitigate winter cold.

There are quite a few others, not so apparent in everyday life. Bubbles of air are quite effective in keeping open ship channels and berths, hydroelectric power intakes, water supply reservoirs both for industrial and domestic use, and even ponds where wildlife congregate. Studies are now being made to determine if St. Lawrence Seaway channels and locks could not be kept open for a longer shipping season, or even throughout the winter, with the use of bubbler systems. Crests of dams, bridge piers and the like are protected from some types of ice damage by the use of compressed air bubbles.

Shipments of frozen ore, coal, aggregates and other granular materials are unloaded faster with the aid of compressed air vibrators that break up large chunks both in railway cars and trucks without damaging the haulage equipment.

Construction work on various types of buildings can be carried on throughout the cold months by enclosing the work area in plastic bubbles supported with compressed air. The air that supports the shelter can be heated to make the area warm enough for efficient work.

In any severe storm, electric and telephone utilities can suffer much damage. Portable compressors delivering air to a variety of pneumatic tools, including clay spades for easily digging frozen ground, make the repair work much easier and restore power and telephone outages with a minimum of inconvenience to users.

Another important use of compressed air is in the charging of fire protection sprinkler lines in warehouses and storage areas where temperatures may plunge below freezing. Sprinkler heads don't freeze when air is behind them, yet when they open, the air flows out quickly admitting water to quench a fire.

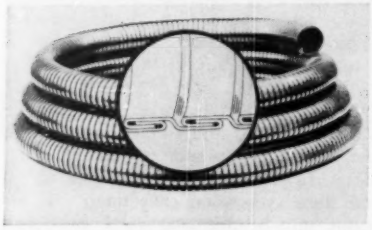
The Army Transportation Corps has developed wheeled vehicles capable of traversing almost any snow- or ice-covered terrain. The weapons and personnel carriers rely on oversized pneumatic tires.

Highway maintenance equipment is, itself, a type of machinery that requires extensive maintenance. It almost always breaks when needed most, but pneumatic tools speed repair and replacement of plows and blades, speed the changing of tires and the servicing of heavily worked engines and running gear parts.

We can also use compressed air to help us off that limb we put ourselves on by pointing out that compressed air not only helps to make hard winters milder, but can reverse the field and help make mild winters a little more severe in the right places. There do seem to be places where it doesn't snow quite as much, or get quite as cold as it used to. In such cases compressed air goes to work to supply the snow. Any time the temperature gets down to freezing, snow-making machines using compressed air to atomize a stream of water can be used to supply enough of the white stuff for ski enthusiasts to get their fill of the sport. Compressed gas refrigerants are also used in the winter months to maintain a glistening coat of ice on skating and hockey rinks, regardless of ambient temperatures.

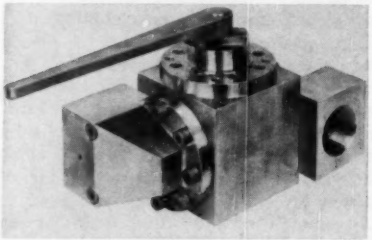
Industrial Notes

BULLETIN, No. IPB-Sec. 3A (a) delves into a wide selection of flexible metal hose specially designed for gravity or pneumatic transfer of grains and bulk materials where resistance to severe abrasion and corrosion is required. Featured are Steelflex (illustrated here) Type U-100, a low-cost standard-weight electrogalvanized carbon steel; Type U-120, in light heavyweight, medium heavyweight, extra heavyweight, and superweight hot dipped galvanized carbon steel; and Easyflo, in standard and



heavyweight, with special galvanized carbon steel or stainless steel liner. Also covered are Type SJQC couplers for mechanical clamp grip, and Type AQC couplers for speedy action automatic lug grip for use on pneumatic transfer systems. *Universal Metal Hose Company*, 2133 S. Kedzie Avenue, Chicago 23, Ill.

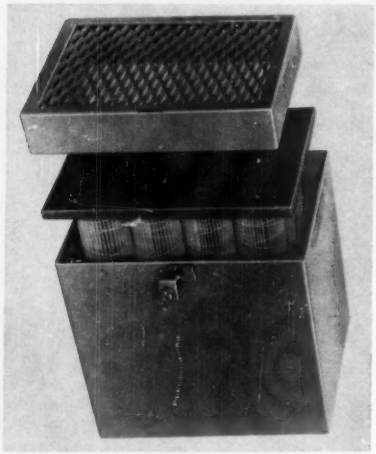
FOR DELIVERING fluids under pressures to 6000 psig, the 3-1103525 high-pressure ball shutoff valve shown can be used. It was specifically engineered as missile ground-support equipment for a propellant loading and pressurization



system handling nitrogen gas at temperatures ranging from −65° to +160° F. The valve reportedly can also handle UDMH and nitrogen tetroxide. With minor modifications it is suitable for service with many cryogenic fluids, missile fuels, and oxidizers from −320° to +350° F. It has a $1^1/_2$-inch line size and is part of a series of high-pressure ball valves ranging from $^1/_4$ inch to 2 inches. Valve body, trim and internal parts are stainless steel. Gaskets and seals are either Kel F or Teflon. Actuation can be pneumatic, manual, hydraulic or by motor or solenoid. Operating torque is 10 foot-pounds at 6000 psig. It is available normally open or normally closed, and can be made fail-safe in either position. *Koehler Aircraft Products Company*, 401 Leo Street, Dayton 4, Ohio.

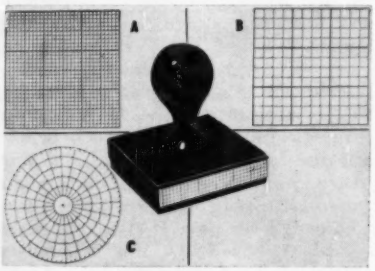
COMPRESSED GAS cylinders for oxygen, argon, or carbon dioxide; for medical gases or propellants; for industrial gases or refrigerants; for vending machines, breathing apparatus, or aircraft oxygen systems—these are some of the many Hackney cylinders described in a catalog published by Pressed Steel Tank Company. The booklet contains specifications, sizes and recommended applications for all the ICC cylinders available for industrial, commercial, medical and domestic gases. Included are high- and low-pressure cylinders, seamless and 2-piece ones. The manufacturer claims that this catalog offers the broadest range of types and sizes available to the compressed gas industry. In addition, included are information on and interpretation of the ICC regulations governing the manufacture, selection and use of compressed gas cylinders. Another section details properties of various permanent and liquefiable gases. *Pressed Steel Tank Company*, 1445 S. Sixty-Sixth Street, Milwaukee 14, Wis.

PAMIC Air Cleaner is a single-stage, dry-type, engine air cleaner. It is available in twelve standard sizes for truck, tractor and stationary engines ranging in horsepower from 10 to more than 1000. The assembly consists of a rectangular housing and a modular filter cartridge. The rectangular shape of the housing provides room for more filter paper than the familiar "tub" configuration. This increase of effective filtration area results in greater dirt-holding capacity and a lower pressure loss for the air intake system. According to company spokesmen, the design has achieved a 50 to 100 percent greater service life



expectancy for the filter cartridge. The face plate of the disposable Pamic cartridge is a rubber-like plastic into which the filter is molded. The face plate thus forms an integral air seal when locked in place in the housing, eliminating the need for spare gaskets or seals. Model R is equipped with an expanded metal grille called a Retainer Frame to lock the disposable cartridge in the housing. Model M, includes a Moisture Eliminator, instead of the Retainer, to prevent airborne water droplets from entering the cartridge. Either model can be equipped with an optional Rain Guard for operation in exposed locations. A Filter Service Indicator, which signals clearly when a cartridge change is required, is also available. *Farr Company*, P. O. Box 90187, Airport Station, Los Angeles 45, Calif.

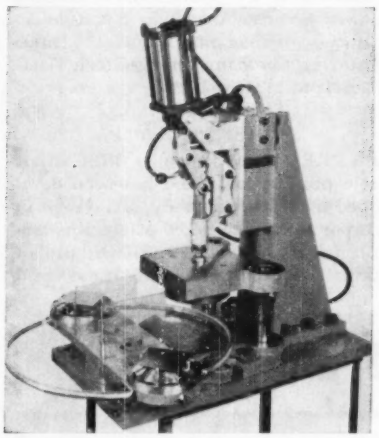
SAVING TIME and labor is a challenge to everyone. The kit shown solves the problem of recording graph material



entailed in engineering notebooks, reports, correspondence, and the like, without using bulky sheets of graph paper. Simply stamp a clear graph

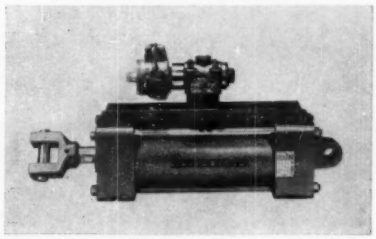
pattern wherever needed. The kit includes three patterns: first, a 100-block-per-square-inch stamp for plotting wave form patterns on cathode ray oscilloscopes, etc; second, a $1/4$-inch grid pattern with sixteen blocks per square inch (plotting a larger scale than the first pattern); and third, a polar co-ordinate graph stamp of 3-inch diameter with major subdivisions at 15 degrees and small markings at each 5 degrees. There is, of course, a large ink stamp pad included. The cost is $10 and may be ordered directly from *Edmund Scientific Company*, Barrington 54, N. J.

DESIGNED to attract attention to the simplicity of adapting De-Sta-Co air-hydraulic operated toggle clamps to secondary operations, Detroit Stamping Company built a low-cost, air-



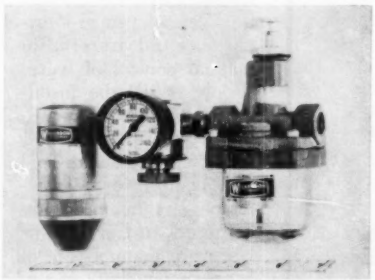
operated press utilizing its heavy-duty Model 850 clamp. At a recent trade show, it formed and imprinted souvenir ash trays with a force in excess of 1000 psi. So many inquiries were received about adapting the unit for other jobs, detailed drawings were prepared. These drawings point up the flexibility of the De-Sta-Co line in forming, piercing, staking and similar operations. Copies of these drawings are now available. *Detroit Stamping Company*, 340 Midland Avenue, Detroit 3, Mich.

JOCKEY air motor design has the valve mounted on top of the cylinder for instant, controlled response, greater compactness and easier maintenance. This integral valve-on-cylinder arrangement seats the valve directly on a manifold that is a solid fixture to the heads. By eliminating the need for an air transfer tube, it is said to be possible to produce a swifter, surer response than with motors whose valves are situated at a distance from their cylinders. Contrasted with in-line motors, which position the valve at one end of the cylinder, the Jockey requires far less linear operating space. At the same time, the design frees both ends of the cylinder for use, making possible double rod end



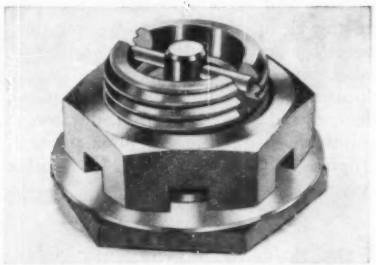
operation. The absence of the air transfer tube and the simplicity of mounting arrangements reduce Jockey maintenance problems to a minimum. With neither tube nor mounting brackets to disconnect, the valve is easily reached for servicing. The device is said to be adaptable to every air motor operation. It can be mounted in a number of ways, including swivel, front flange, foot or clevis. Single, double solenoids, momentary and maintained constant models are available in standard $1^1/_2$-, 2-, 3-, and 4-inch diameters. Larger ones are available on special order. *Lehigh, Inc.*, Air Control Division, Easton, Pa.

COMBOMATIC is Wilkerson's contribution to the field of 1-package filter-regulator-lubricator units. The in-line device is 7 inches long and $4^3/_4$ inches high, so it takes very little space in a pneumatic circuit. Because of its size, it incorporates a completely automatic drain trap on the filter. This prohibits moisture from accumulating in the sump of the filter where water storage is necessarily limited. The filter is all-aluminum with Buna-N seals. A small, all-brass regulator and gauge, controls the pressure of the air. A compact lubricator atomizes fine particles of oil and



is externally adjustable. (The company reports that it can also be made tamper-proof.) A sight gauge is included so the amount of oil being atomized is visible. Two fill plugs permit filling the visible oil reservoir from either side of the lubricator, which can be done while the air pressure is on. Combomatic Model 64240-2 has a capacity of 12 cfm at 100-psig pressure, and is available from stock in $1/4$-inch pipe thread. *Wilkerson Corporation*, 1645 W. Mansfield, Englewood, Colo.

THE DRAIN valve illustrated can be mounted flush to any tank exterior surface, and is said to cost considerably less than similar components. The small valve will drain from within 0.020 inch of the tank bottom to the absolute bottom, depending on the method of mounting. Designated the 5712, it has been approved for fuel-system applications. A slight push with any blunt object the size of a pencil cracks the valve and permits fluid to drain. For extended or complete drainage, an upward push and slight rotation keeps the valve in full-



open position. There are no intermediate drip positions. The valve is either intentionally fully open or positively closed. Although designed primarily for supersonic aircraft, the Bruning valve is now an off-the-shelf item adaptable to more conventional installations. *The Bruning Company*, Lincoln, Neb.

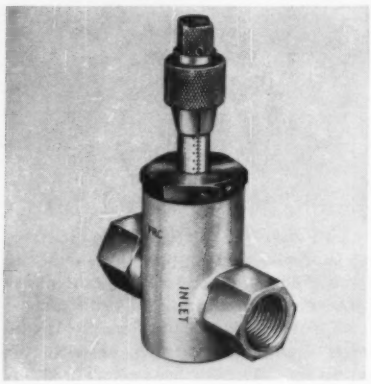
BOTTLE oilers for plain bearing lubrication, Alvor constant oil level controls, glass body oil cups, and bronze oil cups are the subjects of Circular No. 580. Information includes dimensions, oil capacities, installation techniques and application methods covering a wide range of bearing lubrications. *Lunkenheimer Company*, Cincinnati 14, Ohio.

UTILITY TANKS that are portable for industrial, construction and farm use have been announced by The Goodyear Tire & Rubber Company. The fabric tanks range in capacity from 60 to 350 gallons, are offered in eight so-called small sizes, and represent an extension of the principle of Pillow Tanks (with capacities as large as 50,000 gallons) used by the military for storage and delivery of aviation and vehicle fuels in front-line applications where erection of permanent fueling facilities would be impractical. The Utility Tanks are created from finely woven nylon fabric impregnated with a specially compounded rubber, a combination that provides a rugged 1-piece unit suitable for both

static storage and transportation of liquids. The rubber coating is resistant to fuel oil, gasoline, transformer oil, liquid fertilizer and weed sprays. Some of the immediate uses will undoubtedly be the temporary storage of transformer oil during repair or maintenance, storage and movement of gasoline in industrial plants and on farms, transportation of liquid fertilizers and weed sprays on farms, and transportation of water to construction projects. *The Goodyear Tire & Rubber Company,* Akron 16, Ohio.

HEATLESS dryers, purifying systems and miniature compressors are the subject of a 4-page flier, No. 61. Described are hydrogenous (water and oil) adsorbers and central systems for producing clean, pure, especially low dewpoint air and other gases for industrial, laboratory and military use. Typical applications include cooling electronic devices, radar pressurization, microwave transmission lines, and dry-box purging. *Applied Pneumatics, Inc.,* 740 Colfax Avenue, Kenilworth, N. J.

FOR 10- to 100-psig hydraulic circuits requiring constant and accurate regulation of low flow rates, an externally adjustable restrictor-type flow regulator has been introduced by Fluid Regulators Corporation. It features a linear reference scale permanently stamped onto the stationary sleeve for adjusting the

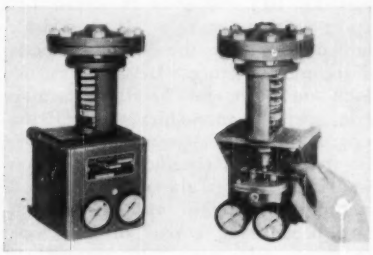


valve flow. The device permits precise flow selection from 0.3 to 1.5 gpm, simply by turning a knurled handknob to the desired point on the linear scale and locking it in position with a knurled lock nut located on the stem. The adjusting screw requires twenty turns to go from minimum to maximum setting, allowing fine adjustment of flow. Accuracy of the regulated flow reportedly is then held within ±2 percent of the flow setting, regardless of variations in system pressure. Constructed of stainless steel and anodized aluminum, the regulator may be used in any low-flow circuit handling fluids compatible with these materials. Operating temperatures of the system may range from —65° to ±275° F with no change in valve performance. Complete engineering specifications are available by writing to the manufacturer. *Fluid Regulators Corporation,* 313 Gillette Street, Painesville, Ohio.

ESTABLISHING consistent standards for power wrench accuracy is the subject of a folder recently published by Skidmore-Wilhelm. It explains how to detect and correct torque—output loss in older impact tools, and lists simple steps of a systematic maintenance program for full production efficiency. Also discussed is a method for calibrating power wrenches to within 2-percent accuracy. *Skidmore-Wilhelm Manufacturing Company,* 442 S. Green Road, Cleveland 21, Ohio.

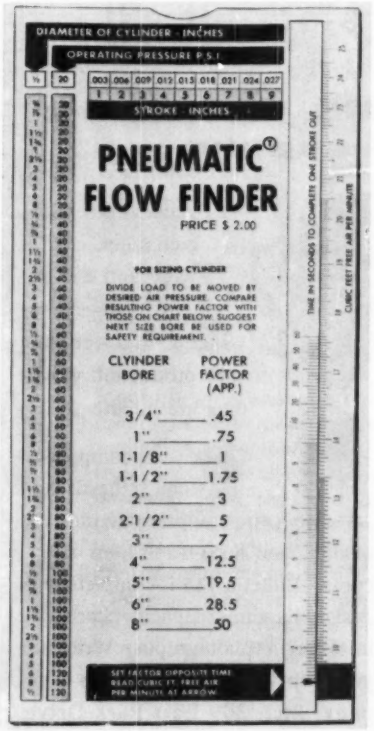
A PRESSURE controller with adjustable proportional band has been developed by Leslie Company. Its design incorporates the features of stability and ruggedness with single known proportional band adjustment to "tune" pilot

response to system requirements. Easy matching of the proportional band controller to the ideal response required in a particular pressure control system overcomes cycling and unstable control tendencies caused by time lags and system inertia. In addition, the controllers reportedly cannot be damaged by weather or outdoor installation; they can be used



in corrosive service too. The devices are available from stock in both direct acting (Type PSAP) and reverse acting (Type PRAP). Engineering drawings and data may be secured from the manufacturer. *Leslie Company*, 111 Delafield Avenue, Lyndhurst, N. J.

COMPRESSED AIR circuit and systems designers should find handy a computer for figuring standard cfm of free air required for any specific job. Called Flow



Finder, the computer gives accurate answers in seconds, figuring free air volume for cylinders of any bore and stroke, at any pressure and time cycle. Even though it is simpler to use than a slide rule, it enables engineers to select all pneumatic components to exact size, and eliminates the guesswork that can lead to premium costs for over- or undersized valves, lubricators, tubing and hose. It determines air pressure for desired cylinder stroke speed, matches cylinder bore size to required force, and tells the minimum compression capacity a system needs. The computer is pocketsized, and costs $2. Quotations are also available on quantity lots, with space for any company imprint and product specifications. *Flow Finder*, Box 578, Westfield, N. J.

Meetings . . .

The University of Minnesota will be the site of the *Fifth Rock Mechanics Symposium* this May 3–5. It is jointly sponsored by the mining departments of the Colorado School of Mines, The Missouri School of Mines & Metallurgy, the Pennsylvania State University and the University of Minnesota. The symposium will deal primarily with problems of "dynamic" rock mechanics, although significant advances in other areas will also be included. It is ten-

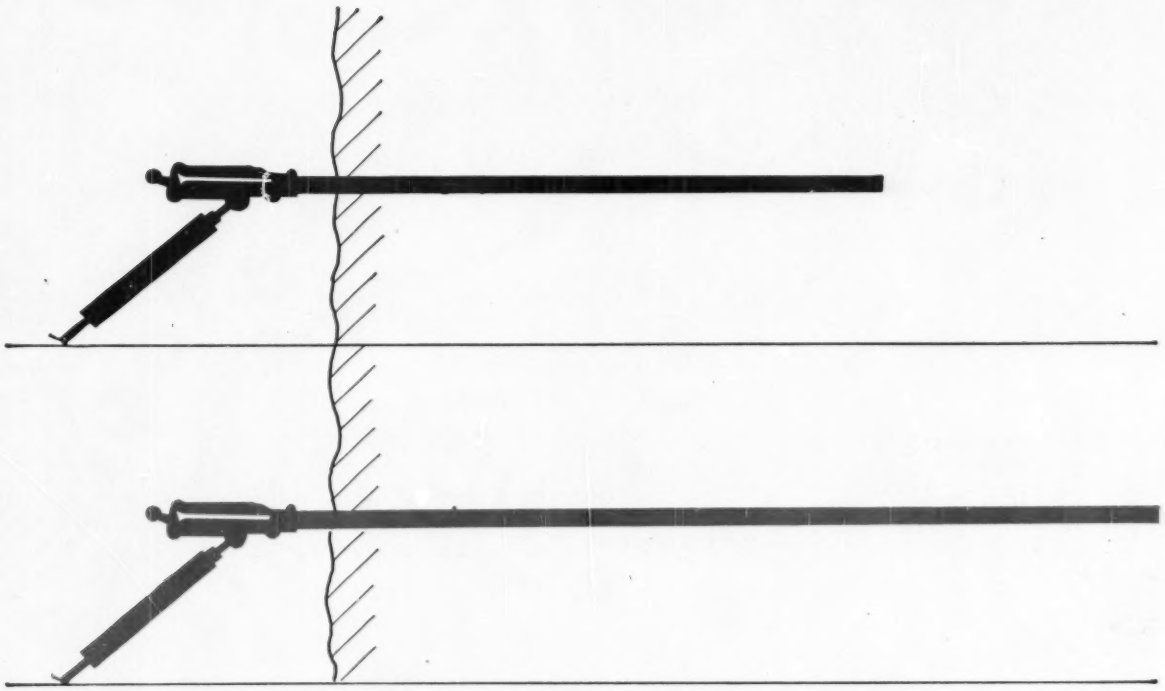
tatively proposed to hold technical sessions in the following topic areas: drilling, blasting, comminution, "dynamic" physical properties of rocks, theories of rock failure and "static" physical properties of rock, and a general area of important contributions as determined from papers submitted for consideration.

Papers for the symposium are now being solicited. Registration details will be available later from the Center for Continuation Study, University of Minnesota, Minneapolis 14, Minn.

Books . . .

Possible Requirements for Radioisotopes As Power Sources, (Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.) was published by the Atomic Energy Commission to give the current status of possible large-scale uses of separated fission products and certain alpha-emitting isotopes in quantities that exceed present availability and market. It discusses evaluations, on the basis of technical feasibility, economics, competition and radiological-safety aspects; applications; specific radioisotopes; and possible large-scale uses. The report was prepared by Dr. William H. McVey of the AEC's Office of Operations Analysis & Forecasting. Interested readers should request bulletin TID-12711 directly from the Office of Technical Services.

Handbook for Technical Writers (published by American Technical Society, 848 E. Fifty-Eighth Street, Chicago 37, Ill.) examines in detail the report writing function. It then deals individually with the various aspects of technical writing. Detailed instructions are given for handling format, style, and the mechanics of preparing reports. A special section discussing the treatment of classified material has been included. A glossary of technical terms and a section on abbreviations have been made a part of this book for handy reference. The authors are R. C. Tracy and H. L. Jennings, and they have prepared the material so that it is adaptable for use both in classroom and industry. The rapid advancement of science and technology has necessitated the writing of technical reports, specifications and handbooks. Since government contractors and agencies are the two primary organizations that generate technical documents, the material in this book emphasizes preparation of documents by these organizations, with primary attention given to the writing of reports. 134 pages. Cost, $3.50.



It's the hole truth... 50% FASTER

Never before in the history of rock drilling has there been a feed-leg drill that could do so much, so easily, as Ingersoll-Rand's new JR-300 Universal Jackdrill. On performance alone, it is 40 to 60% faster than preceding models.

The JR-300 is a lightweight, completely integrated rock drill and flexible air-feed leg unit designed for faster, easier drilling in any position. Three feed legs are available with this new machine: conventional single-acting, telescopic and a new double-acting automatically retractable feed leg. All controls are conveniently grouped on the backhead and the feed handle has a two-position button for feed release or leg retraction which reduces steel changing time and speeds setups.

The same fine performance and design features are available in the new R-300 Stoper and J-300 Jackhamer, simplifying parts inventory where all three types of machines are used.

NEW JR-300 JACKDRILL.

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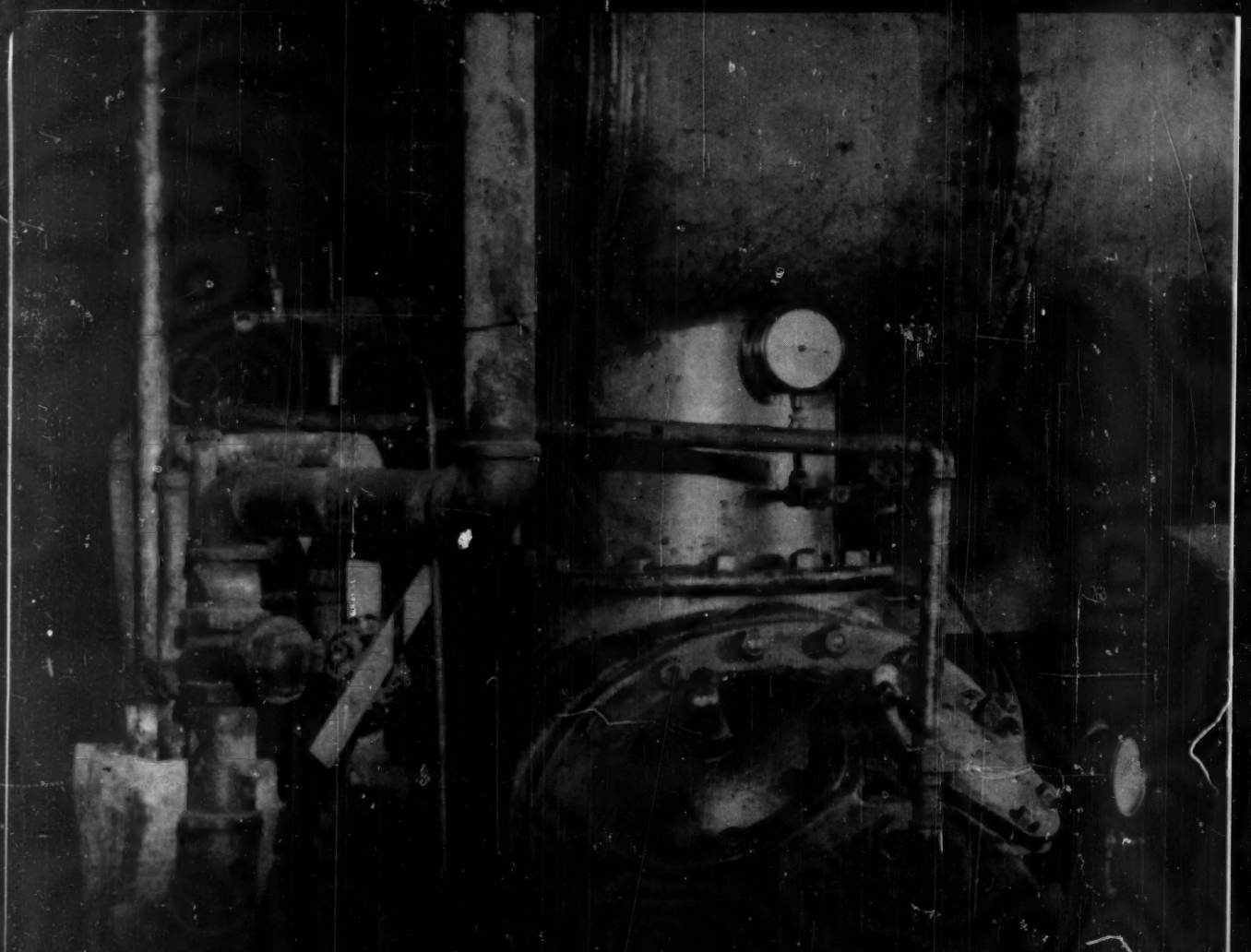
A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK



How Wheeling Steel bought safety... gained efficiency with Cellulube 300

Mr. Kenneth N. Bundy, Superintendent of Utilities Department, Steubenville Works, Wheeling Steel Corporation is responsible for the safe and efficient operation of power house equipment. Air compressor lubricant is fire-resistant Cellulube 300.

Two of three 100 psi. air compressors in power house at Wheeling Steel. Not a single air-compressor fire has occurred at this installation since Celanese fire-resistant Cellulube 300 has been used as the lubricant.

Compressor fires were troublesome before Celanese Cellulube was used in three dual stage, 100 psi. air compressors in the power house of Wheeling Steel's Steubenville Works.

To stop this fire problem, Celanese recommended Cellulube 300. And, since use of this fire-resistant fluid was initiated more than five years ago, there has not been a single fire in any of the compressors! What's more, substantial savings have been gained through reduction in maintenance.

Celanese Cellulubes, available in six controlled viscosities, prevent build-up of hard car-

bon deposits. Cleaner operation eliminates the need for cleaning compressor auxiliaries and greatly reduces frequency of valve cleaning.

Cellulubes give overall protection against wear comparable to that of premium petroleum oils.

Doesn't it make sense to investigate what fire-resistant Cellulubes can do for you in terms of both safety and efficiency? The coupon will bring you complete details. Celanese Chemical Company, 522 Fifth Avenue, New York 36, N. Y.

Celanese® Cellulube®

Celanese Chemical Company is a Division of Celanese Corporation of America
Canadian Affiliate: Canadian Chemical Company Limited, Montreal, Toronto, Vancouver
Export Sales: Amcel Co. Inc., and Pan Amcel Co., Inc., 522 Fifth Avenue, New York 36

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Company_____

Address_____

City_____ Zone_____ State_____

My application for Cellulubes is_____

FOR LOADING LONGER LARGER TRUCKS...

NEW EIMCO 631 EXCAVATOR

For operations that need a larger machine than the famous Eimco 630 Excavator, Eimco now offers the new 631 Excavator, with higher discharge, able to easily and fully load longer and larger trucks.

The Eimco 631 has greater power, with the air operated unit, for example, featuring the new Eimco 22 horsepower motors. Able to handle substantially greater tonnage as well as discharging into larger kibbles, tubs and dumpters.

Standard discharge height is 8 feet, with headroom of 11′ 2″. Other discharge heights available. SAE bucket capacity is 12½ cu. feet. Minimum overall height is 6′ 5″ and operating width is 5′ 8⅝″. This all-steel machine weighs 13,000 pounds.

For full specifications and data, write for Bulletin L-1172 to The Eimco Corporation, P.O. Box 300, Salt Lake City 10, Utah, U.S.A.

EIMCO

"Advanced Engineering and Quality Craftsmanship Since 1884"

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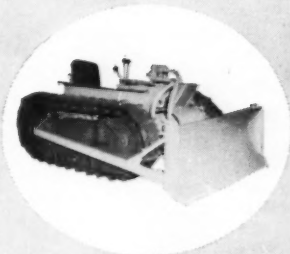
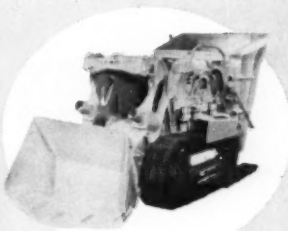
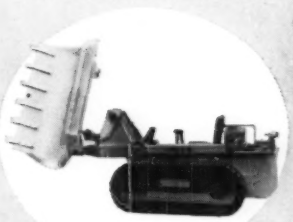


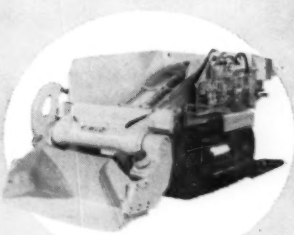
630 DOZER AND EXCAVATOR



631 HOPPER-LOADER AND NEW EXCAVATOR



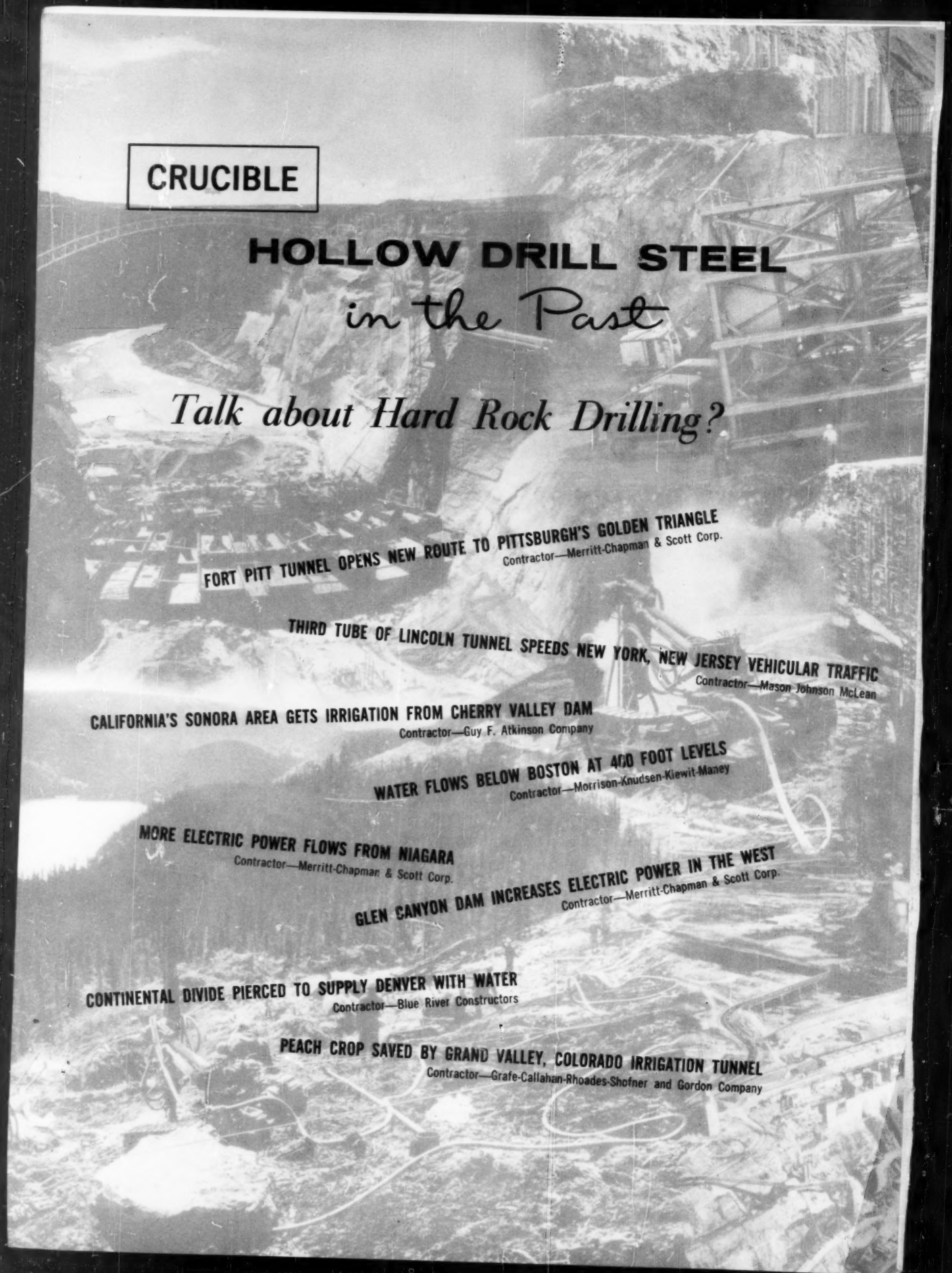
632 SIDE DUMP FRONT END LOADER AND DOZER



635 CONTINUOUS LOADER

Every Eimco crawler-mounted dozer and excavator features independent power to each track for maximum maneuverability; solid, sound steel construction; ease of control; safety and excellent stability.

Highlights of specifications are in Bulletin L-1057.


CRUCIBLE
HOLLOW DRILL STEEL
in the Past
Talk about Hard Rock Drilling?
FORT PITT TUNNEL OPENS NEW ROUTE TO PITTSBURGH'S GOLDEN TRIANGLE
Contractor—Merritt-Chapman & Scott Corp.
THIRD TUBE OF LINCOLN TUNNEL SPEEDS NEW YORK, NEW JERSEY VEHICULAR TRAFFIC
Contractor—Mason Johnson McLean
CALIFORNIA'S SONORA AREA GETS IRRIGATION FROM CHERRY VALLEY DAM
Contractor—Guy F. Atkinson Company
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Contractor—Morrison-Knudsen-Kiewit-Maney
MORE ELECTRIC POWER FLOWS FROM NIAGARA
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GLEN CANYON DAM INCREASES ELECTRIC POWER IN THE WEST
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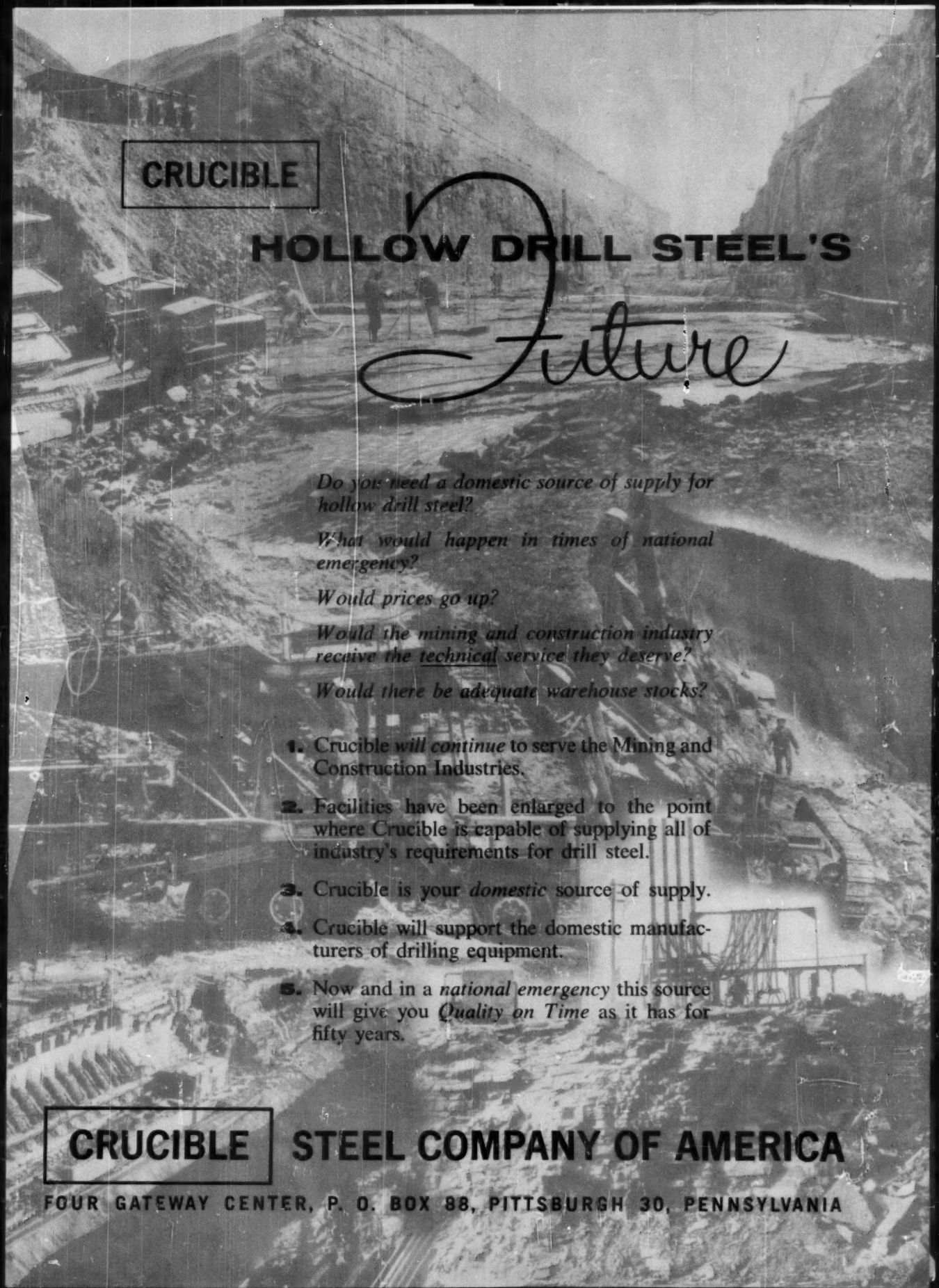
CONTINENTAL DIVIDE PIERCED TO SUPPLY DENVER WITH WATER
Contractor—Blue River Constructors
PEACH CROP SAVED BY GRAND VALLEY, COLORADO IRRIGATION TUNNEL
Contractor—Grafe-Callahan-Rhoades-Shofner and Gordon Company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Future
Do you need a domestic source of supply for hollow drill steel?
What would happen in times of national emergency?
Would prices go up?
Would the mining and construction industry receive the technical service they deserve?
Would there be adequate warehouse stocks?
1. Crucible will continue to serve the Mining and Construction Industries.
2. Facilities have been enlarged to the point where Crucible is capable of supplying all of industry's requirements for drill steel.
3. Crucible is your domestic source of supply.
4. Crucible will support the domestic manufacturers of drilling equipment.
5. Now and in a national emergency this source will give you Quality on Time as it has for fifty years.
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Index to Advertisers

Adams Company, Inc., R. P.	32
Anaconda Company	3rd Cover
Armstrong Machine Works	36
Celanese Chemical Company— Division Celanese Corp. of America	34, 35
Compressed Air Magazine Company	40
Conrader Company, Inc., R.	36
Crucible Steel Company of America	38, 39
Dollinger Corporation	1
Eimco Corporation	37
Garlock, Inc.	2nd Cover
Ingersoll-Rand Company	6, 7, 33, Back Cover
Naylor Pipe Company	2
New Jersey Meter Co., Inc.	36
New York & New Jersey Lubricant Co.	31
Punch-Lok Company	32
Sarco Company, Inc.	30
Siewert Engineering Company, Inc.	36
Van Products Co.	40
Editorial Index	3

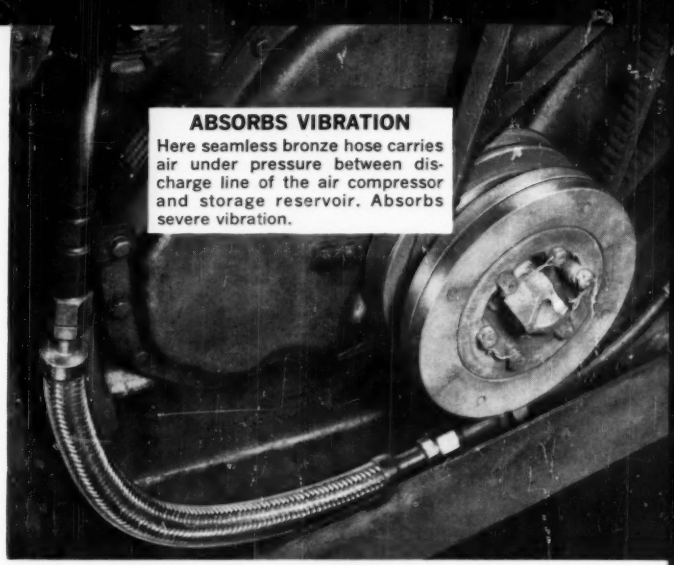
For performance under pressure—

ANACONDA METAL HOSE

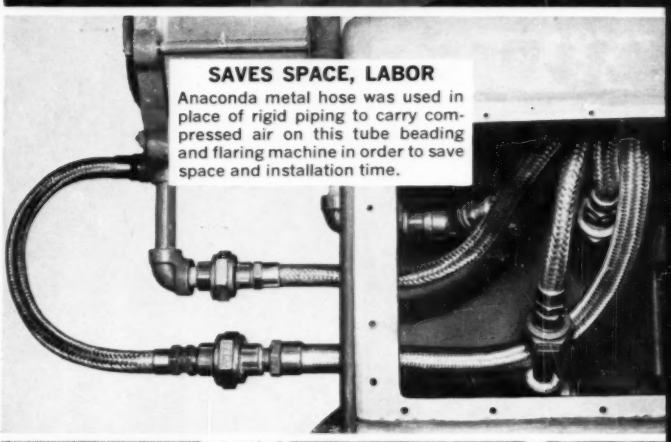
Absolutely tight, highly flexible, really rugged . . . Anaconda metal hose can be depended on for long, maintenance-free service. It's the leading choice in compressed air applications, because it will take punishment, control vibration and compensate for expansion and contraction.

Available I.D.'s: ⅛" through 48", in many types, in many metals including bronze and stainless steel. Ask for Anaconda Metal Hose at leading distributors. For more information, write to: Anaconda Metal Hose Division, Anaconda American Brass Co., P.O. Box 791, Waterbury 20, Connecticut. 61-1144

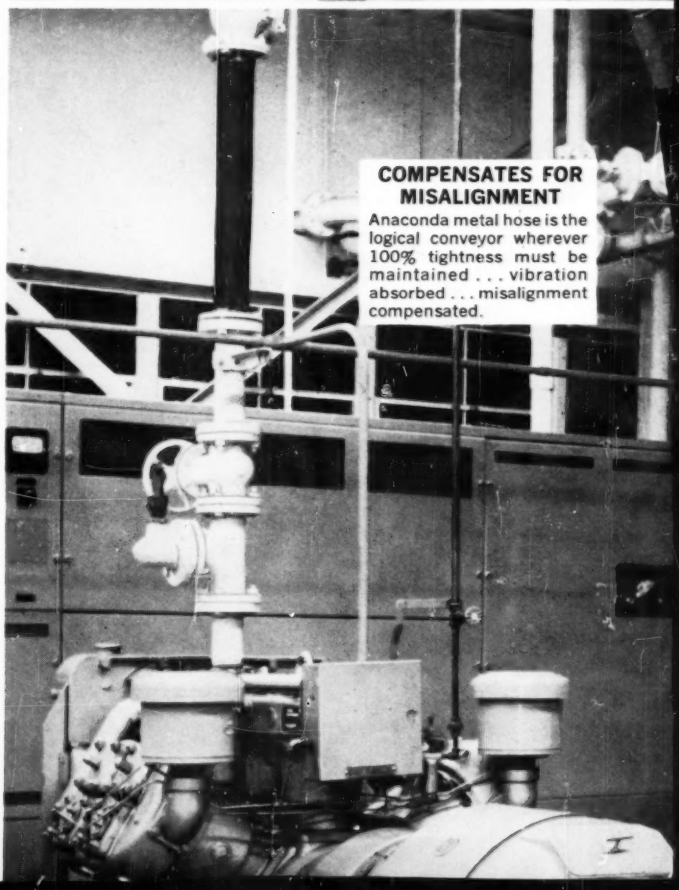
ANACONDA®
METAL HOSE DIVISION



ABSORBS VIBRATION
Here seamless bronze hose carries air under pressure between discharge line of the air compressor and storage reservoir. Absorbs severe vibration.

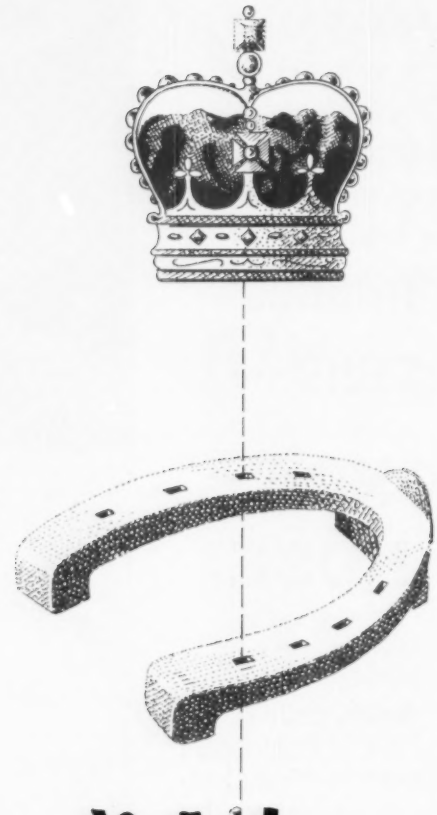


SAVES SPACE, LABOR
Anaconda metal hose was used in place of rigid piping to carry compressed air on this tube beading and flaring machine in order to save space and installation time.



COMPENSATES FOR MISALIGNMENT
Anaconda metal hose is the logical conveyor wherever 100% tightness must be maintained . . . vibration absorbed . . . misalignment compensated.

"For want of a nail
the shoe was lost
For want of the shoe
the horse was lost
For want of the horse
the rider was lost
For want of the rider
the message was lost
For want of the message
the battle was lost
For want of the battle
the kingdom was lost"



FOR WANT OF A NAIL THE KINGDOM WAS LOST!

The modern version of this old adage might begin, *"For want of a bearing . . ,"* or *"For want of a valve . . ,"* or

"For want of a part,
your product was lost!"

Large losses may result from small things. A gas-engine compressor consists of about 1400 individual parts, each important to the operation of the machine. The parts are like links in a chain — the dependability of the whole is only as good as the weakest part.

Every part of an Ingersoll-Rand compressor, or *any* machine that will carry the I-R trademark, is designed and manufactured for top dependability and performance in relation to every other component. But no mechanical wearing parts will last forever, and eventually some must be replaced. Then the machine can be restored to its original condition *only* with genuine Ingersoll-Rand replacement parts.

Today, through Ingersoll-Rand's newly-expanded service facilities, spare parts for engines, compressors and pumps are readily available from warehouse stocks in all principal cities, as well as from enlarged service departments at I-R plants. For fast service and *dependability*, just call your I-R representative.

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